SCIENTIFIC AMERICAN

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THE PANAMA CANAL.

The present condition of the work of excavating the interoceanic canal, which comprises the removal of about three billion cubic feet of rock of varying consistency, may be summed up as follows: 2,450,000,000 cubic feet, 350,000,000 of which had already been excavated on the 31st of last December, are to be removed by the different firms, according to terms of contract which fix the finishing of their work at successive dates in 1885, 1886, and 1887. The 1,000,000,000 cubic feet making up the entire volume of the cutting will be removed either by the same parties (which appears to be most rational), at the close of their present contracts, or by new parties, who, like their predecessors, shall accept fixed epochs for the delivery of their work in a finished state.

Two billion four hundred and fifty million cubic feet of the canal, then, are now given up to the dredges and excavators of the twenty-one principal contracting firms. Six hundred and thirty million cubic feet, about, must be finished by the first of August of the present year; about fifty million in June, and about one billion two hundred million on the first of October, 1886. The balance comprises the two extremities of the canal, that is to say, the low and easy portions. The twenty-one contractors represent an expenditure of about forty-eight million dollars, of which 13 go to French contractors, 11 to American, 20 to Italian, Swiss, Swedish, and native, and 90 to an Anglo-Dutch company. The money to be paid the French is in part for work on the Emperador cutting, which we represent in Fig. 3, and the location of which will be seen on the map (Fig. 1). This work takes its name from quite a large village situated upon the Atlantic side of the Culebra. Emperador is the center of a section of the great cutting, between the Obispo section, which marks the foot of this side, and the Culebra section, upon the crest of the Cordilleras. Upon examining the topographic plan in Fig. 1, we find that in this extent of three and a half miles the Emperador section embraces a broken central portion where rise Mounts Lapita, Cerrito, and Campement. These highlands are in places quite rocky, and it is in one of such localities that the excavators are seen working in our engraving. Beneath Mount Campement, toward the Culebra, the Emperador section traverses the valley of the Obispo and the plain of Livio. Like all the sections of the Isthmus, the Emperador works are connected with the railway from Colon to Panama. They are likewise connected with the works at the great dam, over which the trains of cars, hauled by locomotives, go to deposit the excavated material that is to form the retaining wall of the Chagres waters. The Emperador cutting has, at certain points, a width of 650 feet. Immediately after the Emperador come the colossal Culebra works. It is between Mts. Culebra and Livio that the canal will be widest, as shown in Fig. 2. Four hundred and fifty million cubic feet of this section are being removed by the Anglo-Dutch firm, Messrs. Cutbill, Watson, and Van Huttum. This firm has contracted to remove all the rock above the level 50 (see map). As the great cutting has a maximum depth of 370 feet, the contractors will have to remove the solid rock to a depth of 230 feet.

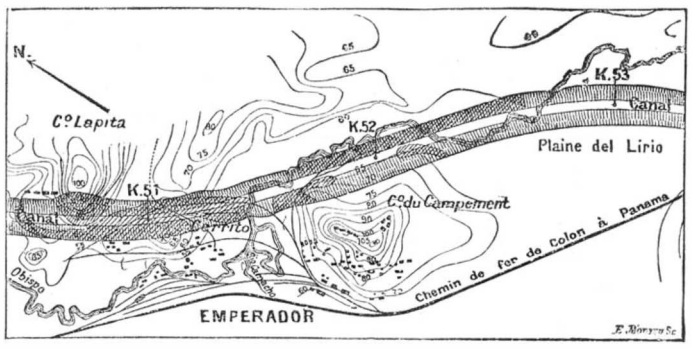


Fig. 1.—FIELD OF OPERATIONS AT EMPERADOR.

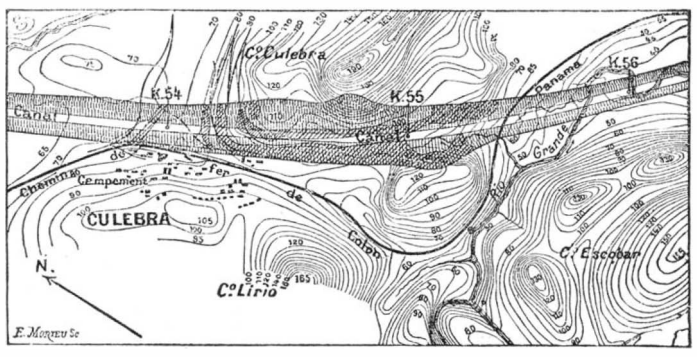
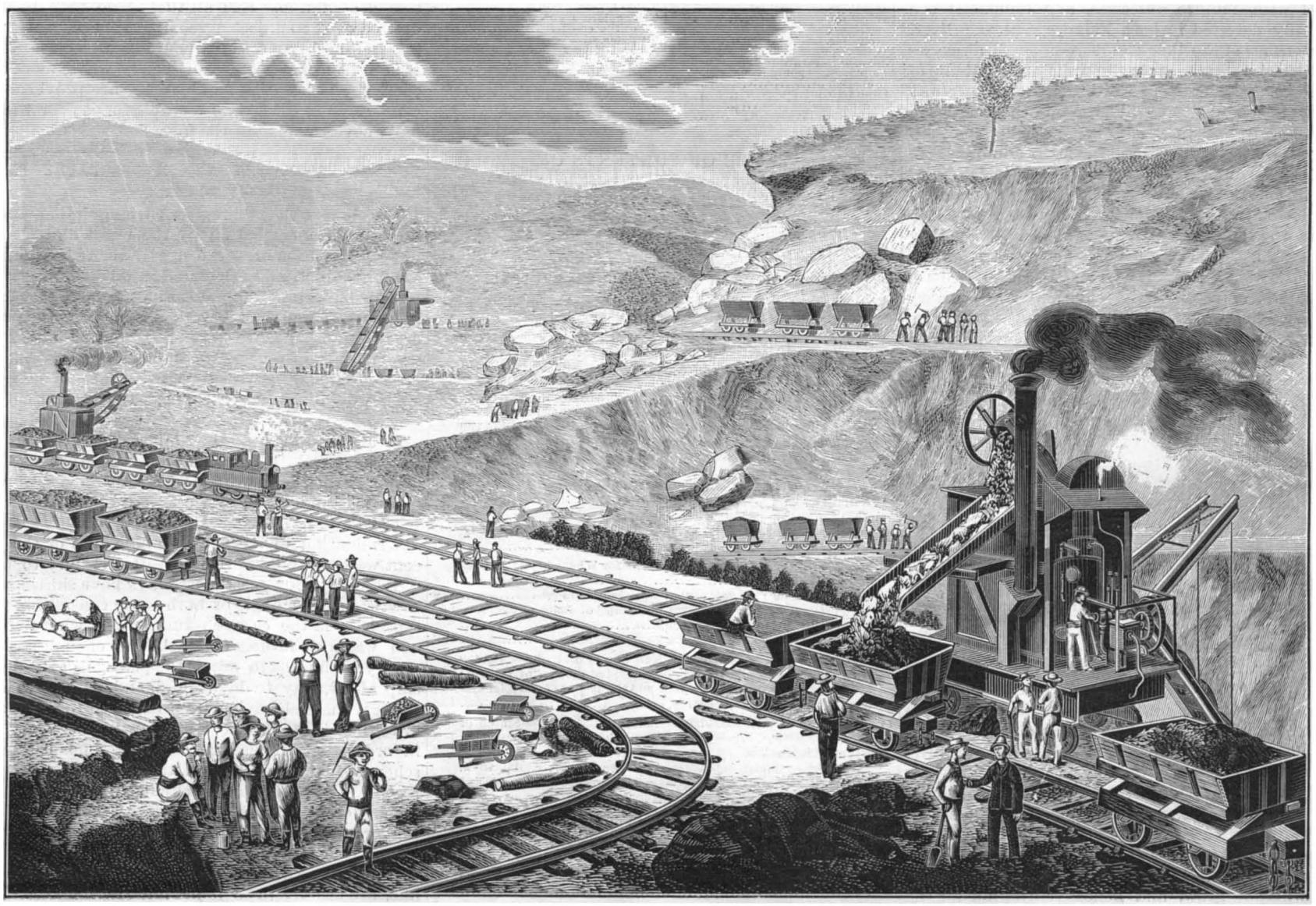


Fig. 2.—FIELD OF OPERATIONS NEAR THE CULEBRA.

It seems to be indicated that, after the completion of the work that they have accepted, the same contractors will finish the cutting. The Culebra and Emperador works have for direct corollary the establishment of the Gamboa dam.

While the excavation of the canal, the dredging of the low portions, the construction of the Chagres dam, and the excavating of the side drains are going on, the ports of entrance on the Atlantic and Pacific will be established. Extensive dredging operations have already been begun at Colon. A platform of earth, provided with a mole at its eastern extremity, has been constructed with the material taken from the Kenny's Bluff quarries near the roadstead of Colon. Upon this platform spreads out a new city, Christopher Columbus, containing workshops, stores, dwellings of the employes, etc. All these structures are connected with



THE PANAMA CANAL.—Fig. 3.—SCENE OF OPERATIONS NEAR EMPERADOR.

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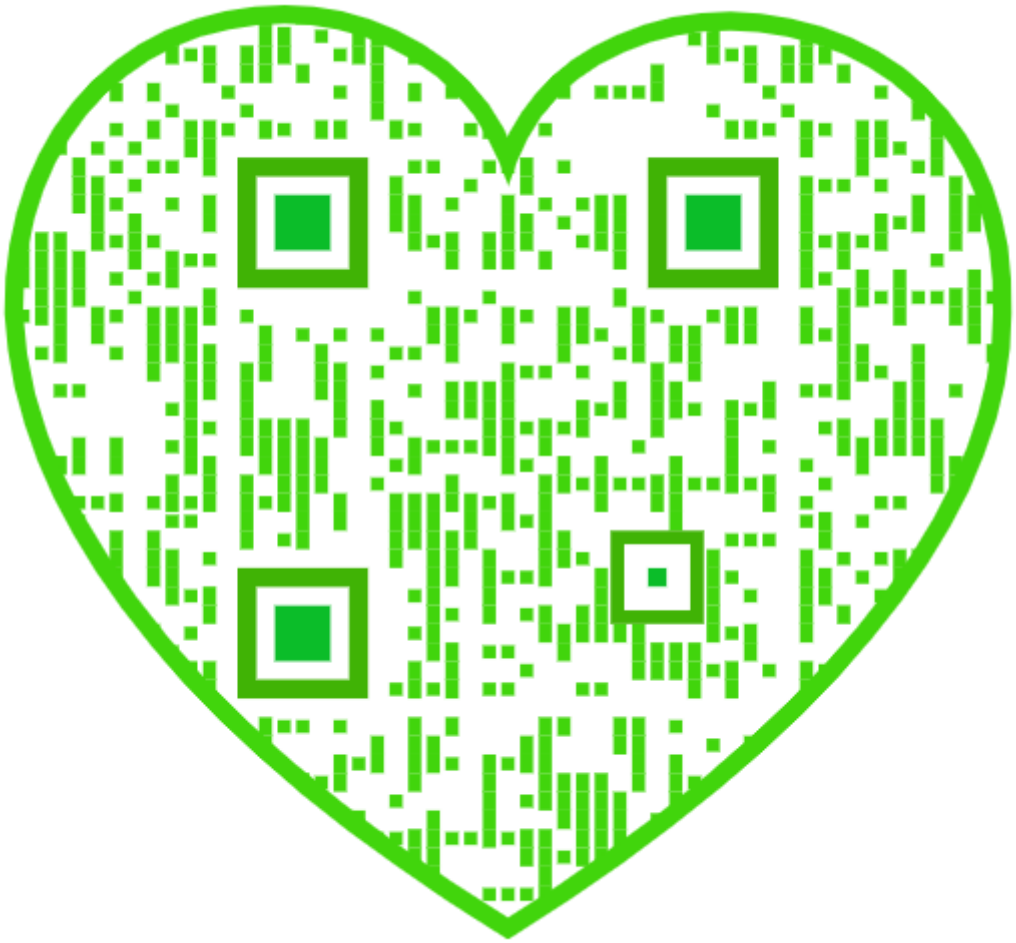

each other and the Isthmus railway by branches. Ships of the greatest draught can unload, free from the reach of the wind, alongside of wooden wharfs that project into the sea. On the Pacific side the establishment of a terminus port at Boca presents no technical difficulty. A maritime channel three hundred yards in width will form a true outer port, in which ships will be able to station themselves for their preliminary operations, and the left bank of which will be provided with tracks that connect with the railway.

Last March six large dredges were being mounted at Boca, and are certainly now in active operation.

This colossal installation, and all these fields of operations, over which are maneuvered hundreds of machines, thousands of cars, and a formidable *materiel*, required a special organization for the service of the transports, the starting, and the repairs necessitated by continuous work. For this reason the Isthmus has been divided into three sections—from Colon to San Pablo, from San Pablo to the Culebra, and from the Culebra to the Pacific—with the central seat of the shops at Matachin, at the foot of the dam and the great cutting. The entire stock of tools, apparatus, etc.—that which is to be sent to the different fields of operation, and that which comes from the latter for repair—is concentrated at Matachin. The Isthmus railway, which is now the property of the Interoceanic Canal Company, wonderfully facilitates that moving about of the implements, etc., upon which depends the regular operation of the different sections.

In short, more than two-thirds of the canal are now underway, with a formal engagement on the part of the contractors to have their sections finished at an epoch that shall not exceed the end of 1887. The execution of the canal, then, is a problem that is now solved. The parties who have contracted to perform their work cannot break their agreement. The company, moreover, holds in reserve sufficient tools to allow the engineers at a given moment either to replace or aid any contractor who is getting behind. All the contracts contain a special clause that gives the director-general of the works the right to step in with his own machines and his own men in any case of this kind.—*La Nature.*

Ova of Bilharzia in the Lungs.

From a communication to the *Unione Medica Egiziana* of June 15, by Dr. Belleli, it appears that genuine ova of bilharzia hæmatobia have been discovered in the lungs. The patient was an adult man, who died in the Hopital des Diaconesses at Alexandria. He had been admitted a few days before his death with purulent cystitis, consecutive to the bilharzia disease. Rigors and intermittent fever were the chief symptoms, and pyæmia was diagnosed. An autopsy was made, and the bladder. liver, kidneys, and lungs removed for examination. The walls of the bladder were infiltrated with the ova of bilharzia. One of the kidneys was studded with minute abscesses, and numerous ova were easily detected in both kidneys and the liver. On the surface of the lungs numerous small abscesses of variable size were seen; in the walls and contents of these abscesses, the eggs of the bilharzia were found. The eggs in the lungs were like those in the bladder in every respect, but they were much less numerous. Nearly all the eggs were found in the interlobular connective tissue; a few were detected in the intralobular and peribronchial structures. The situation of the ova corresponded to the distribution of the finer ramifications of the pulmonary artery, along which they had traveled. The connective tissue in the neighborhood of the blocked vessels had undergone a process of proliferation of recent date. The other pulmonary tissues were in various stages of inflammation and suppuration. This occasion is said to be the first on which the eggs have been discovered in the lungs. The adult worm lives in the portal vein, and the eggs are distributed thence. It is supposed that in the present case the ova passed from the vesical veins into the hypogastric veins, and so into the vena cava inferior, whence they would traverse the right heart, and so get lodged in suitable branches of the pulmonary artery. Another route might be through the communication between the portal and systemic systems, by way of the hæmorrhoidal plexus. A third mode of transit is suggested in the vessels of a certain caliber, which are said to provide direct communication between the portal trunks and the sub-hepatic veins or vena cava inferior. —*Lancet.*

SPEAKING of the rotting of timber, the *Builder* says: "The *Merulius lacrymans* is the common wood fungus that destroys nine-tenths of the wood with which we are acquainted. The reason of it being common to new buildings and not to old is that moisture, one of the constituents of its existence, is more present in new, green buildings than in old, dry, seasoned ones. The two prime conditions of its existence are moisture and heat; if moisture is present without heat, it will not grow, and hence its depredations, in the winter time are unknown. If heat is present without moisture, it will not grow, and hence ventilation for the passage of a current or dry air will prove fatal to its existence.

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MANUFACTURING PROSPECTS.

A number of interviews, held recently with the proprietors and managers of representative manufacturing establishments in a New England State, afford some interesting if not positive information relative to the prospects of manufacturers.

Out of the number visited, fourteen establishments may be taken as representative. These comprise the makers of machine tools, steam engines, hand tools, cutlery, sewing machines, guns and pistols, machine screws, bench hardware, builders' hardware, drop forgings, patterns. A number of these branches are duplicated in the visitations.

Taken as a whole the reports are favorable, not only for present work, but for prospective business. In one establishment the hours of work have been doubled during the month of August; the factory had been running on half time for several months. This increase of time is not due to a "spurt" of a single order, but to a gradually increasing pressure of small orders. Two machine tool establishments have lately increased their force of hands, and are busy filling recent orders; they both say that they have few finished tools in stock. The steam engine builders complain of a lack of orders; there does not appear to be many new manufactories starting, and few which are increasing their power. The call for bench tools for iron and wood has lately received an impetus from fresh orders; but possibly this may come from dealers whose stock has run low. Cutlery, guns, pistols, and sewing machines are more in demand than they were three months ago—April and May—and the manufacturers are confident that "the good times" are about to come again. Machine screws are affected largely by the manufacture of machine tools and manufacturing machinery; but this industry, which has lagged slightly, is coming up to a healthy if not a driving condition. Bench hardware has suffered considerably; the dealers have a considerable supply on hand. In some localities builders' hardware has been in brisk demand all through the spring and summer, and there is an increase in orders. Drop forgings are special as well as regular, and the former seem to have increased in orders, while the latter have not materially fallen off.

So these facts as to the actual state of work may be properly supplemented by the combined opinion of the managers of the manufactories. On the whole, the impression gained is that our manufacturing business is beginning to increase; the deadlock is to be removed, and the dullness of years is to be gradually changed to an activity that shall give competent labor remunerative employment, and invested capital profitable returns.

As to the cause of the present relative inactivity, opinions differ. Probably there are combined causes, which do not resolve themselves into a comprehensive explanation. But all those who have been addressed on the subject agree upon one cause—that of production beyond the requirements of the people. It is a remarkable state of society where more of all comforts, necessaries, and luxuries are provided than can be sold to those who are able to pay for them; it may, nevertheless, be the fact.

THE TRIANGULATION AND HYDROGRAPHY OF THE COAST.

The charges that the work of triangulation and hydrography, as carried on by the Coast and Geodetic Survey, has been arranged so as never to be completed are misleading, and calculated to do much injustice to a really important and meritorious service. It matters not what action shall be taken regarding the present organization, the work of triangulation and hydrography must of a necessity be continued by the government, for otherwise the coast charts of many districts would only serve to mislead the mariner and cause disaster.

If all harbors and the approaches thereto were formed of rock, having channel ways that never varied, a single hydrographic survey made with care and precision would suffice for all time; and the scheme of triangulation when once developed and used for the determination of the hydrographic lines of the adjacent waters, would never thereafter require to be redeveloped. But most waterways have shifting channels; sands or shingle or both are in constant activity, especially in the case of estuaries, and what ten years ago was a six fathom channel, large enough under ordinary conditions to admit the passage of the deepest ship afloat, may to-day be high and dry at low water, the real channel having been deflected to the one side or to the other. Hence a resurvey is necessary, and in order that it may be accurately made, the old scheme of triangulation on the shore must be resurrected. Under favorable circumstances this can be quickly done. In the case of large cities, for instance, the prominent points near the water line, such as church steeples, the flagstaffs on the forts, the cupolas of residences standing on elevated ground, and the like, are usually to be found laid down on the charts, and so no laborious work with the transit instrument is required. But in sparsely populated districts, as

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about the bays and sounds of North and South Carolina, and indeed on a great part of the coast, only a granite block with crosshairs cut in the top marks the various points in the triangulation, and as these, especially on sandy coasts, are taken out and utilized by the fishermen as anchors, the "points" have to be redetermined or other ones made before the work of hydrography can even be started.

A few weeks of clear weather will generally suffice to redevelop the triangulation, but if such a scheme had never been carried out, the preliminary labor to be performed would be immense; a whole season and perhaps two would intervene before the hydrographers could begin operations. An observatory would have to be erected, protracted astronomical observations taken, and a base line measured—a tedious and delicate work.

Hence it is that the statements in the recent Washing dispatches to the effect that "the survey of the coast is likely to last for a thousand years," though intended evidently for irony, do not necessarily prove a lack of expedition in the work, nor a reason for its discontinuance.

THE REIS TELEPHONES.

It is a well received principle in patent law that an invention is protected for all possible uses, even for such as were unforeseen by the inventor. In some of the voluminous testimony and arguments of the Bell telephone suits, it has been suggested that the transmission of articulate speech was not contemplated in the original Bell telephone patent. Yet under the law such a feature would not invalidate the patent, which would be good for all its uses.

The same state of things exists in the case of the old Reis telephone. Philipp Reis invented, constructed, and experimented with a number of different kinds of telephones during a period extending from 1859 to 1874. He died in 1874. Precisely in accordance with modern telephone practice, he divided his instruments into two classes, transmitters and receivers. These instruments have been repeatedly tried of late years, and it has been definitely determined that they will transmit articulate speech. It would seem therefore that in them would be found the complete anticipation of Bell's broad claim to the electrical transmission of speech. But the point is made that in Reis' hands his instruments did not effect this. It is argued that they were only designed to transmit sounds in general, such as the tune of an air sung into the receiver, or the notes of a piano or other musical instrument. The analogy between the position of the 1876 Bell patent and the Reis telephones is perfect. In both instruments is latent the capacity for transmitting speech, but by neither Bell nor Reis was this power distinctly claimed.

In view of the really striking analogy, the anticipation seems most complete. Both inventors appear on the field with devices adapted for the same end, but neither with perfect distinctness claims this function as a part of the invention.

The courts in their sweeping decisions in favor of the Bell patent dispose very summarily of Reis' inventions. In one decision the judge rather gratuitously says that a century of Reis would not have produced an operative telephone. By all the decisions Bell's claims have become so broadly construed that the actual Reis telephone could not be used without infringing them, if it were so used as to transmit speech. In other words, if one of our readers were to place a Reis transmitter in one house and a Reis receiver in another, and connect them by wire, and were to talk over such a line, he would constitute himself an infringer of Bell's claims, though he was using an invention made by a man who died two years before the date of Bell's 1876 patent. If Reis himself, as is almost certain, spoke through his telephones, he ought to be considered an infringer in advance of his time. Seriously speaking however, the bearing of the Reis inventions upon the Bell claims depends on the following facts: Reis' telephones did transmit sound; they probably transmitted speech in the days of the inventor, as they are perfectly capable of doing so at the present time. This much should constitute them an anticipation of the broad claim to electrical transmission of speech. But their effectiveness as anticipations would be vastly increased if it could be definitely proved that speech had been transmitted by them during Reis' lifetime.

Numerous passages from Reis' writings are cited to prove this. But they all are considered unsatisfactory to about such an extent as is the Bell patent of 1876, in its own claims to speech transmission. An appeal to Reis' contemporaries has been made with far more fruitful results. In Professor S. P. Thompson's work on the Reis telephone, a number of letters from friends of Reis are printed. Many of the writers are men in high standing in the scientific world. The letters are in some cases to the effect that articulate speech was received through the telephones as early as 1859–1864. Others are not so definite as to the facts. But the general unanimity of all on this subject is most striking. They effectually disprove of the "century of Reis" theory, so firmly upheld by one of the circuit judges.

The fact is that the scope of the Bell patents as determined by the courts is a monument to the ability of the lawyers engaged by the Bell Telephone Company. So thin a series of claims were in all probability never before made to protect a monopoly so securely. We are firm believers in according protection to inventors. The recent tendency of the courts to destroy patents should certainly be deprecated by all who have the real interest of the country at heart. But, in equal measure, the unjust broadening of claims should be condemned by all. A monopoly of an extent measured by one hundred millions of dollars should not be sustained on any but a solid basis. The inventor, Mr. Bell, has reaped ample reward for any merit that did exist in his labors. As his work seems to have been so largely anticipated, and as the public are really suffering from the rigid monopoly awarded his stock company, it is time his claims were more carefully scrutinized and their extent limited. This work we hope will be effectually done by the Supreme Court, whenever the case will be properly presented to them.

The general opinion of patent lawyers is that the United States Supreme Court has been too rigid in its dealings with original patents and reissues. Few patents comparatively can stand before it. The Bell patents have not yet reached this last tribunal. When they do, some restriction will certainly be placed upon them. It will not be strange if the much criticised action of the court in patent cases shall at last be productive of good, and tend to defining and restricting the extent of a monopoly that has become a public evil. The morals of the case and justice to the inventor have been amply satisfied. It now is only a question of how to deal with the members of a giant corporation. On the one hand is the comparatively limited number of stockholders, on the other hand is the public at large. The inventor and his family have all reaped fortunes out of the patent. The corporation itself has founded a business that the entire annihilation of the patents would not destroy. Thus even in the destruction of the Bell patents no hardship would be done, and the public would be vastly benefited.

Fire Losses.

The *Chronicle* fire tables for 1885 contain a review of the total losses from fire in the United States and Canada during the past ten years, which shows an appalling destruction of values from causes largely preventable. During this single decade, the loss of property by fire amounted in the aggregate to nearly $900,000,000, a sum so large as to be quite past belief, did it not rest upon undeniable statistics.

The distribution of this immense loss has been rather curious. Upon the assumption that the average loss per capita amounts to about two dollars a year, we find that two-fifths of the annual combustion occurs between elevations of 500 and 1,000 feet above the sea; three-fifths, where the mean annual temperature ranges from 45° to 55°; two-fifths where the mean annual temperature of July is from 70° to 75°; nine-tenths where the range of maximum temperature is from 95° to 105°; seven-tenths where the annual rainfall ranges from 35 to 50 inches, and three-tenths where the rainfall of spring and summer is from 20 to 25 inches. Between the 40th and 41st parallels of latitude and the 73d and 84th degrees of longitude a greater loss occurs than between any others.

Since 1880, the fire losses have been increasing rapidly, the greatest difference coming between the years 1882 and 1883, when the increase amounted to $16,000,000. The monthly proportion shows also a number of curious features. While the losses during other months are quite variable, they seem to be very regular in February and March. The widest ranges have been noticed in January and in the early fall.

The causes of fires have also been carefully classified, and the results show an alarming predominance of incendiarism and of defective construction scarcely less criminal. For several years past, approximately one-third of all fires were the work of incendiaries, and the percentage in the different States and Territories varied in 1884 from 11 per cent in California to 62 per cent in Kentucky.

These variations seem to have no dependence upon density of population, but show an undoubted connection between incendiarism and illiteracy, although the States named represent by no means the apex or base of the social pyramid. The monthly curve of incendiarism for the years 1883 and 1884 shows two periods of maximum outburst, the smaller occurring respectively in May and April, and the larger in September and October.

Under other divisions, equally curious results have been obtained. Take, for instance, the influence of atmospheric conditions. As one would expect, the greater loss occurs during the dry season of the year, when everything is more easily inflammable, and the means for extinguishing fire are less available. But the difference is less than would be supposed. In the number of fires the excess in the dry season is only 4 per cent, while the greater loss is 17 per cent, showing that the real discrepancy is due to the greater destruction wrought by fires rather than to the actual increase in their number. The statistics show further that, other things being equal, the fire loss of a locality, for any considerable period, varies inversely with the rainfall.

At the present time, in the United States and Canada, we are suffering a monthly loss from fires of almost $10,000,000—a tremendous tax upon our wealth producing power. While the scheme of insurance has mitigated the burden somewhat by distributing it over many shoulders, it has given rise to a deplorable falseness in the popular reasoning. People have come to believe that a policy cancels loss, and it must be confessed have come likewise to act upon the principle. Omitting the flagrant immorality of incendiarism, there is still a large class of apparently respectable citizens who permit themselves to regard the preservation of property for which others are responsible as less sacred than if the weight of loss rested upon themselves.

We can only look for the decrease of fires in any community where there is a proper building inspection, and still more where there is a healthy state of moral sensitiveness.

Industrial Comparison between Illinois and Massachusetts.

The most interesting portion of the report of the Illinois Bureau of Labor Statistics is that devoted to a comparison of the industrial conditions of Illinois and Massachusetts. As similar methods of inquiry were followed in the two States, there is the more value in the results obtained. The following conclusions are made: Twenty-one industries, represented by 2,440 establishments, were taken in Massachusetts, and 34 industries, represented by 1,666 establishments, in Illinois. The 2,440 establishments of the former State employed 207,793 hands; the 1,666 establishments of the latter employed 95,912 hands. The whole number of manufacturing establishments in each State is about the same, Illinois having 14,549, and Massachusetts 14,352. Illinois has 1,848 establishments in which $5,000 or more was paid in wages during the census year, and 1,666 of these were used in the investigation. Massachusetts has 3,663 establishments in which $5,000 or more was paid in annual wages, and 2,440 were used in the investigation. Thus there appears to be in Massachusetts nearly twice as many large establishments as in Illinois, and not only a greater number, but the establishments themselves are more extensive, as is shown by the fact that the average number of employes to each in Illinois is only 57+, while the average for each establishment in Massachusetts is 85+.

In Massachusetts, 30·13 per cent of all employes are women, while in Illinois only 12·16 per cent are women, and the preponderance of this class, and the laws governing their employment in Massachusetts, prepare us for finding 80+ per cent of the establishments in Massachusetts running 10 hours, as against 63+ per cent of those in Illinois. This disparity is modified somewhat by the fact that 26+ in Illinois run less than 10 hours, as against 16+ per cent of those in Massachusetts; but, on the other hand, the number of those which run more than 10 hours is much greater in Illinois than in Massachusetts.

In Illinois children and youth constitute only 6·07 per cent of all employes; by far the largest percentage, 37·75, being found in the tobacco factories. In Massachusetts, 4·93 per cent of the workers are children.

The daily earnings are $1.51 in Illinois and $1.23 in Massachusetts, and the yearly earnings in the former are $430, and in the latter $358. Both amounts seem very low, but it must be remembered that they are not the yearly earnings of men, but an average of all the earnings of men, women, and children. As Massachusetts employs nearly twice as many women and children in her industries as Illinois, this large proportion of cheap labor would doubtless account in a great measure for the discrepancy in these averages of earnings in the two States.—*Bradstreet's.*

A Waterspout.

A dispatch from San Antonio, Texas, July 6, says: "Yesterday morning, near Walden, 150 miles west of here, an eastbound freight train was struck by a waterspout. The engineer saw the spout approaching, bounding along like a rubber ball, tearing up the earth and uprooting all in its way. He reversed the train to avoid the waterspout, whose course was tortuous. Just as the waterspout reached the line of the road it changed its course, and pounded along parallel with the road with frightful velocity. When opposite the train it burst, deluging the engineer, fireman, and brakeman, who abandoned the train and climbed some trees to avoid a wave of water fully eight feet high and about 100 feet wide. The locomotive and 14 cars were raised bodily and carried nearly 200 feet from the track, while the roadbed was completely obliterated. No one was hurt. The extent of the damage is unknown. Through trains west of here on the Sunset road have been abandoned. Roadbeds and a number of bridges have been washed away by recent heavy rains."

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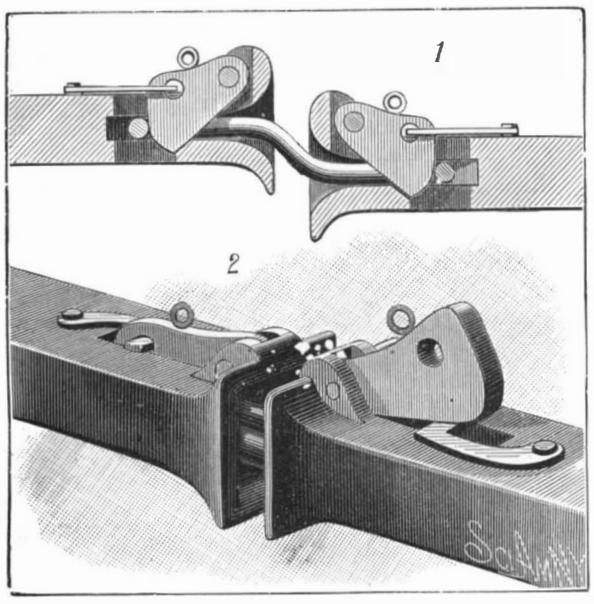
CAR CCUPLING.

At the top of the front end of the drawhead are jaws between which is a slot extending to the rear. Between the jaws is pivoted a coupling lug, formed as clearly shown in the cut, and free to swing up and down in the slot. The entering link strikes the bottom beveled edge of the lug and raises it; the lug then drops into the link. The lug is locked in place by the prong of a hook pivoted on top of the drawhead being passed into the hole in the lug. The hook is shifted by means of a hook on one end of a rod, whose other end is slightly curved and tapered. To uncouple, the prongs of the hooks are withdrawn, and the lugs are raised by means of the rod, the tapered end of which is passed into the eyes on the top edges of the lugs. By holding the lugs raised by placing the prongs of the hooks under them, the cars may be run together without coupling. This

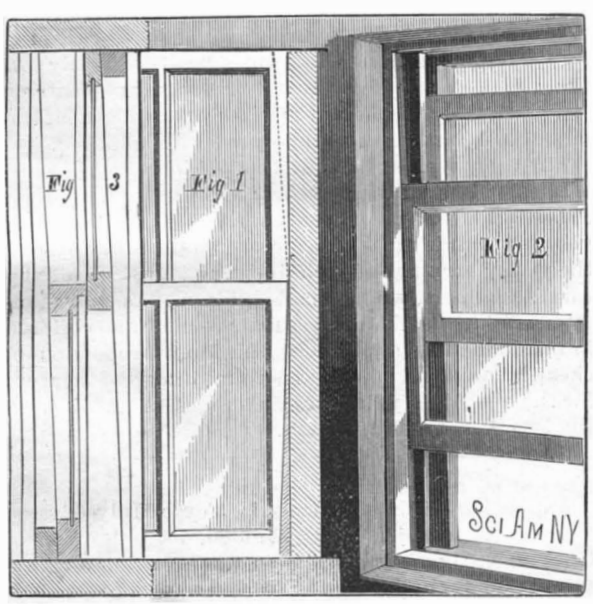


FIELD'S CAR COUPLING.

coupling—invented by Mr. Henry Field, Jr., of New Bedford, Mass.—may be strongly built, and does not require the brakeman to enter between the cars at any time.

WINDOW SASH AND FRAME.

An invention lately patented by Mr. George W. Henry, of 195 Broadway, New York city, consists of a window frame and sash so constructed with inclined or wedge-shaped surfaces as to make perfectly air-tight joints at all points between the frame and sash when the latter is closed. Fig. 1 is a sectional elevation of half the window, Fig. 2 is a perspective view, and Fig. 3 is a transverse sectional elevation. The lower strip of the upper sash is thicker horizontally than the upper one, and the side strips are inclined at their outer surfaces, being thickest at their



HENRY'S WINDOW SASH AND FRAME.

bottoms, as shown in Fig. 3. The edges of the side strips are also inclined, as indicated by the dotted line in Fig. 1. The sash is thus formed with inclined surfaces in all directions, front, back, and edgewise. The lower sash is made in the same way, and the two sashes are placed in the frame with their widest parts at the center. The upper and lower portions of the frame are so formed that when the sashes are closed there will be a wedge fit at all points, whereby all dust, snow, and water will be excluded, and there will be no rattling of the sash. This invention may also be applied to solid sliding hatchways or doors, and to other frames placed in openings and adapted to slide.

THE SKIAGRAPH.

Wood engraving, although undoubtedly still preferred by most publishers for illustrating books and periodicals, has of recent years been to a great extent superseded by photo-electrotyping. In this process the pen takes the place of the graving tool, and an artist thoroughly familiar with this kind of work can produce most pleasing effects at a cost below that of wood engraving. The skiagraph (shade delineator) has been devised for the use of such artists, and with its aid an endless variety of shades can be introduced on a pen and ink sketch.

Its capacity in this respect is almost unlimited; as many different shades or tints can be produced as designs can be by the kaleidoscope. For artists engaged on sketching illustrations for manufacturers' catalogues this instrument will be found to be a most valuable auxiliary, and in the hands of those who know how to use it to the best advantage, all kinds of artistic work can be executed in a manner comparing favorably with engraving.

In the accompanying cut, *a* is a bed plate having on its upper surface a central socket; *b* is a revolving plate having on its lower surface a central pin fitting in the socket; *c* is the tint plate carrier, resting on the revolving plate; *d* is the tint plate, resting on the carrier; *e* is the tint screw, by which the carrier and tint plate can be moved backward and forward. By this movement tint lines can be thickened up to any desired shade. The tint plate and carrier can be locked at any angle at which they may be placed by means of the locking screw, *f*; *g* is the surface plate, on which is screwed the hardwood sketch frame, *i*; *h h* are adjusting screws to regulate the distance of the surface of the pen and ink sketch from the surface of the tint plate.

The artist first makes a light pencil sketch on the upper surface of a sheet of drawing paper stretched on the frame, *i*. Then with pen and ink he makes the outlines and does all the other pen and ink work, except that to be done by the skiagraph. The next step is to screw the frame, with the face of the sketch down, on to the surface plate, which can be lifted on or off the instrument as often as may be required. The drawing paper being semi-transparent, the artist then, on the back surface of his sketch, makes a pencil outline of the surface on which he wishes to produce a certain tint. The tint plate, having been inked over with printer's ink, is put in position, and that part of the drawing designed to receive the tint is pressed down to obtain the desired impression. By using the tint screw for thickening lines, the revolving plate for cross lines, and combining the shades produced by several tint plates, almost any desired effect can be attained. The sketch when finished is placed in the hands of the photo-engraver, and a plate ready to print from can be had in a very short time.

This invention has been patented by Mr. Edward H. Brown, of 7 Warren Street, New York city, who will furnish particulars regarding United States and foreign patents.

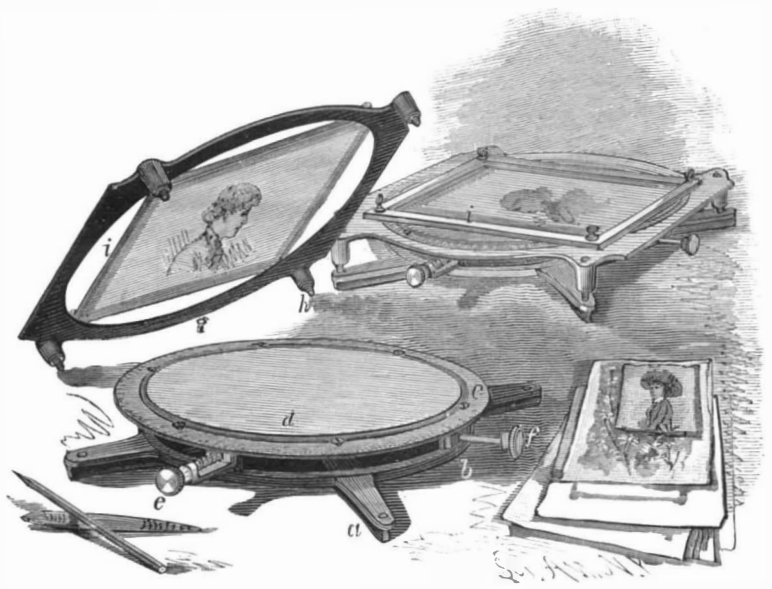
Waters of Sugar Works.

It is remarked that a sugar works consuming daily 4,000 cwt. of beets furnishes as much foul water as a town of 20,000 inhabitants, and discharges as much organic impurity as a town of 50,000 inhabitants. The waste waters contain suspended matters, *i. e.*, fragments of beets, dissolved organic matter, both nitrogenous and non-nitrogenous, and salts, sulphates, chlorides, and phosphates. Hence all conditions for energetic putrefaction and the multiplication of bacteria are present. The author recommends precipitation followed by irrigation, except when the effluent can be conveyed into a large river, "the water of which will play the part of the soil."—*A. Bodenbaender.*

SMOKE-CONSUMING FURNACE.

Much inventive genius has been expended upon the suppression of the smoke nuisance, and a great number of plans, more or less effective, have, from time to time, been brought forward for this purpose. The device which we illustrate is one which has been suggested by Mr. John L. Peslin, of Appleton, Wis., who built a a small experimental furnace several years ago, and succeeded in obtaining very satisfactory results. The first figure shows the self-closing fire door in perspective. The central axis, about which it rotates, is provided on its end with a clover-leaf cam working against a small roller which is pressed upward by a spring. In consequence of this construction, when the fire door is partly revolved to admit the coals, as shown at the left of the second figure, the clover-leaf cam presses the roller down, and the spring is brought into greater tension. As soon as the fire door is relieved of pressure, therefore, the action of the spring on the cam returns it to its first position, and the door is closed automatically.

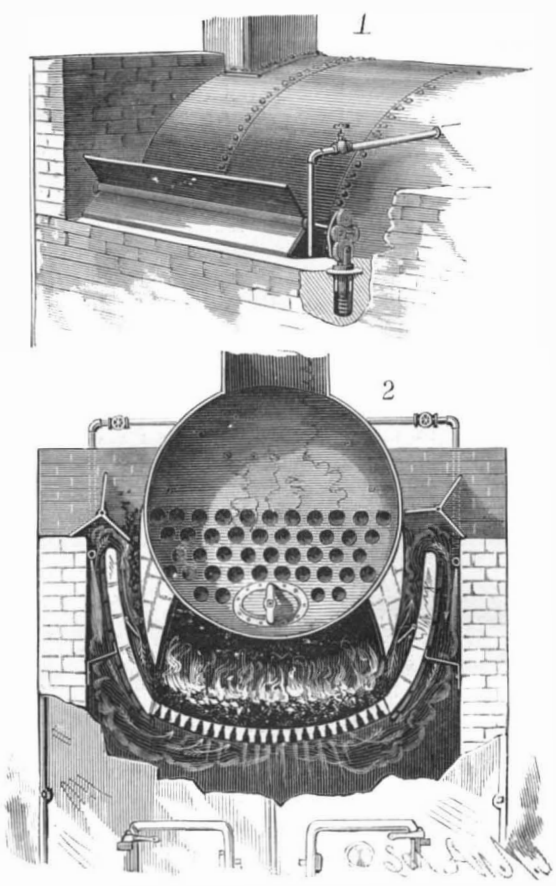
The second figure illustrates the general action of the furnace. The grate is curved in cross section, and is fed with coals from each side. The body of the fire is constantly red and glowing, for the supply of fuel being added from the sides and not from the top, as ordi-



BROWN'S SKIAGRAPH.

narily, there is no sudden lowering of the temperature, and consequently no evolution of smoke in the main fire chamber over the grate. Smoke, nevertheless, is produced, and in quite large quantities, but its generation is limited to the coal chambers at the side of the fire box, and it is fully disposed of without having a chance to find its way to the smoke stack. Its course is illustrated by the arrows. Jets of steam at each side create a strong downward draught, and force the smoke to find an outlet through the layer of burning coals. By this baptism of fire the finely divided particles of carbon, whose suspension in the mass constitutes smoke, are brought to the temperature of combustion, and pass off through the stack as carbonic acid chiefly, though if there be insufficient air, carbon monoxide will also be among the products, and will be a source of lost energy, but quite invisible, and without the disagreeable qualities of smoke.

Dampers are provided in each fuel chamber, as



PESLIN'S SMOKE-CONSUMING FURNACE.

shown. By this preliminary heating, the coal is deprived in a large measure of its volatile constituents, and by the time it reaches the zone of combustion on the grate, will be reduced to the condition of an imperfect coke, and therefore incapable of generating smoke. Doors are provided at the front of the fire box, both to admit the necessary air and to permit of stoking the fire. It has not been our pleasure to see this furnace in operation, but its plan embodies correct chemical principles, and on independent grounds we are quite prepared to believe the inventor's statement that it is very effective in preventing the contamination of the atmosphere by smoke.

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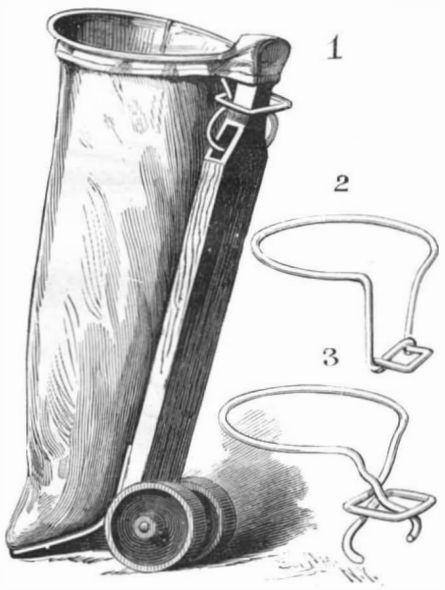
COMBINED BAG HOLDER AND TRUCK.

The truck board, provided at its lower end with wheels and foot piece, has its upper end tapered to form a handle having a head. In each side of the lower part of the handle is a longitudinal groove. A metal rod, Fig. 3, from ⅜ to ½ inch in diameter, is bent to form a large loop, which may be square, circular, or oblong, and the inner ends are bent down and crossed



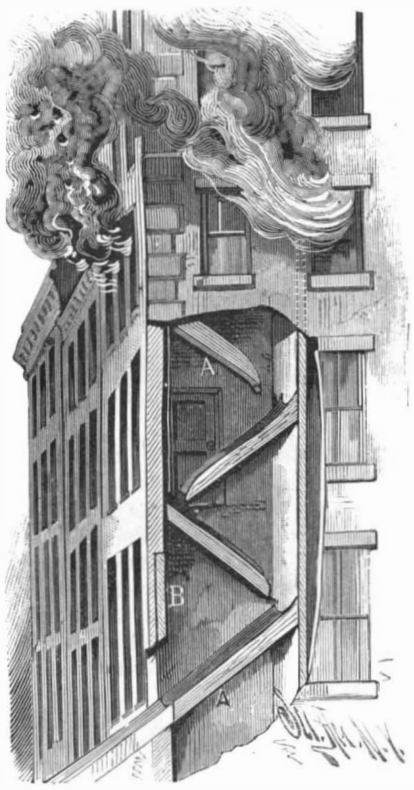
HATZ'S COMBINED BAG HOLDER AND TRUCK.

to form a loop, and are then bent inward to form hooks. The holder is placed on the front of the board at the upper end, the handle portion is passed through the small loop, and the hooks are passed into the side grooves. The open end of the bag is passed through the large loop, and the end seam is turned down over the outside of the loop and over the head. The bag can then be easily filled, as its mouth is held open, and as the weight in the bag increases, the top is held more firmly on the loop. If desired, the loop can be formed as shown in Fig. 2, the ends being bent to form a square frame and the hooks being dispensed with. Moving the filled bag about is facilitated by its being held to the truck.

This invention has been patented by Mr. Casper Hatz, of Big Stone City, Dakota.

FIRE ESCAPE.

In a vertical shaft on the inside or outside of the building, a fire escape is erected consisting of a series of inclined ways or chutes, A, which are secured to the walls or arranged between them, and are alternately inclined in opposite directions, the lower end of one chute being a short distance above the upper end of



GOLLINGS' FIRE ESCAPE.

the next lower. Two chutes are placed for each story, one extending from the floor to the middle of the story below, and the other from the middle to the floor below, and so on. The upper surfaces of the chutes are hollowed out, and carpet or canvas is secured to the top edges of the sides to form an elastic support. At each floor is a door located at the upper end of a chute. At the lower end of the lowest chute is a door, B, sliding vertically in a recess in the wall; attached to this door is a wire extending upward on the side of the shaft and connected by a wire, passing over a pulley, with the swinging edge of the door at each story. By opening any one of the doors the wire is pulled upward and the sliding door raised. Persons step from the floor upon a chute, and sliding down alternately in opposite directions, are landed on the ground. If desired, a sliding piece may be arranged on the bottom chute in such a manner that it will slide out and form a continuation of the chute when the door is raised.

This invention has been patented by Mr. Henry Gollings, of Beltzhoover, Pa.

How to Keep Moths Out of Carriages.

As this is a subject of very great importance, especially at this season of the year, we will not wait until we have tested the remedy suggested by an old trimmer, who has been using it for a number of years back, and claims for it a comparative victory over those destructive pests known as moths. His plan is an invisible one, and strikes at the very harboring places they infest. The plan is a mixture of the paste, and will not in any way impair the quality of the paste nor stain the linings, as might at first be supposed. The paste is made up in the usual way with fine tar mixed in it, in the proportion of two tablespoonfuls to a gallon of paste.

By putting this in the paste you will readily see that the preventive is distributed throughout the whole carriage. The odor, it is said, remains a long time, but is not sufficiently strong to render it disagreeable to smell; hence the advisability of using it in the carriage business.—*Carriage Monthly.*

Geological Survey of New Jersey.

The Director of the State Survey, Prof. George H. Cook, is now preparing a complete atlas of New Jersey, several sheets of which are already issued. Including the margin, they are each 27 by 37 inches, and are intended to be folded once, making the dimensions of the atlas 18½ by 27 inches. When completed there will be seventeen of these sheets, drawn to the uniform scale of one mile to the inch. Those so far issued are six in number: No. 2, Southwestern Highlands; No. 3, Central Highlands; No. 4, Northeastern Highlands; No. 6, Central Red Sandstone; No. 7, Northeastern Red Sandstone; and No. 16, Egg Harbor. The remaining eleven sheets are expected to be issued during the course of the next three years. A small map of the State is published on the titlepage sheet, and by its division into numbered rectangles affords an easy key to the system of mapping employed.

It seems to have been the purpose to so divide the State that each separate map should show its territory grouped around some center of either geological or commercial importance. Though the plan necessitates much repetition, many localities being thus made to appear on four different sheets, it possesses undoubted advantages in making the maps more convenient for local use, and this, after all, is the chief object of such surveys, or should be. The topographical part of the work is excellent, and is unsurpassed by that of any State, not even excluding Pennsylvania from the comparison, the maps of which have gained a cosmopolitan reputation.

HARNESS ATTACHMENT.

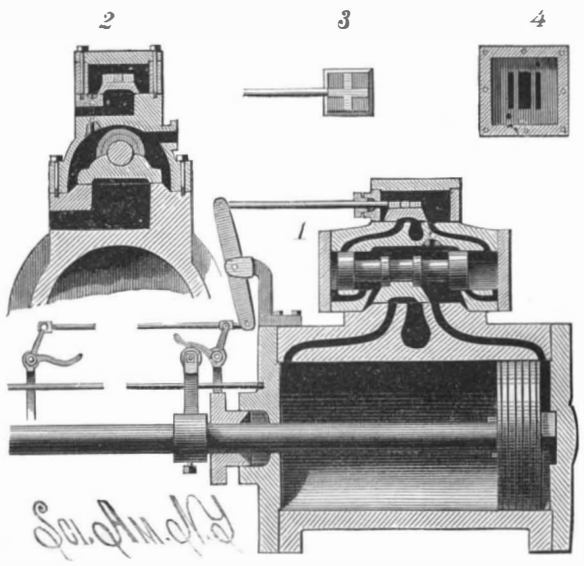
The engraving represents an invention patented by Mr. John Siebel, of Oskaloosa, Iowa, which consists mainly of an oscillating yoke or frame to which the shafts of the vehicle are attached. Leading from the vehicle, which may be of any approved construction, is a long, upwardly curved reach that extends over the horse to the back pad of the harness. The forward end of the reach is forked, and each piece is formed with an eye. Secured to the back pad are blocks formed with lugs in which the horizontal arms of the yoke are journaled. The ends of these arms are formed with eyes that constitute guides for the lines of harness. The yoke is composed of an upper and lower bow, provided at their centers with studs on which the eyes of the reach are placed. These studs form pivots to permit the horse to turn without cramping the reach, and the yoke arms form horizontal pivots, so that in passing over uneven ground the up and down movement of the horse and vehicle will not cramp the back pad or reach, nor interfere with the free motion of the horse.

SIEBEL'S HARNESS ATTACHMENT.

EXPERIMENTS conducted by the Dutch State Railroad on the behavior of different paints for ironwork have shown that red lead best resists the action of the atmosphere. It was discovered, too, that the coat holds better on iron plates cleaned by pickling than when the plates have been scraped or brushed. The trial sheets were pickled with hydrochloric acid, washed with warm water, dried, and oiled while still warm.

STEAM ACTUATED VALVE.

Held on the piston rod outside of the cylinder is a collar, from which projects an arm having a roller pivoted on its upper end. Through an eye in the arm passes a guide rod having one end fixed in the head of the cylinder and the other end fixed in a suitable support, so as to prevent the piston from turning and swinging the arm out of a vertical position. Pivoted on an arm on the end of the cylinder is a lever, whose lower end is connected by a rod with two angle tappets (shown in Fig. 1) pivoted on suitable uprights. The cylinder is provided with steam passages leading from the chest to the two ends, and with the usual exhaust passage. A supplementary steam chest is formed on top of the main one, and contains a slide or other valve (Fig. 3) connected with the upper end of the lever. On the bottom of the main chest is a slide valve moved by a shaft having



HORSFIELD'S STEAM ACTUATED VALVE.

on its ends pistons that fit closely in cylindrical chambers in the ends of the chest. Ports formed in the bottoms of these chambers extend from a point at the bottom near the outer end to a point at the inner end, as shown in Fig. 1. Ports also extend from the bottom of the upper chest down to the top of the other, and establish communication between the two. Live steam is conducted into the lower chest through a side opening, shown in Fig. 2. When the parts are in the position shown in Fig. 1, live steam passes through the channel to the right hand end of the cylinder, and forces the piston forward; the exhaust passage is then open. Live steam is also in the passage leading to the right hand chamber of the main chest, and also between the end of the opposite chamber and its piston, and in the corresponding short passage. As the piston nears the end of its stroke, its arm strikes the tappet, and the valve in the upper chest is shifted; the shifting of the steam actuated valve then takes place. The route taken by the steam upon the return stroke may be easily understood from the drawing. Fig. 4 is a plan view of the bottom of the supplementary steam chest.

This invention has been patented by Mr. Alfred Horsfield, of Hazleton, Pa.

Tiers-Argent.

This alloy is much employed in the factories of Paris for the manufacture of silverware. As is indicated by its name, it consists of one-third, or 33·33 per cent, silver and two-thirds, or 66·66 per cent, aluminum, and is worked to great advantage both by reason of its cheaper price (the kilogramme [43 ounces 3 dwts.] costing about 90 francs) and its superior hardness; at the same time, it is more easily pressed and engraved than the silver-copper alloys.

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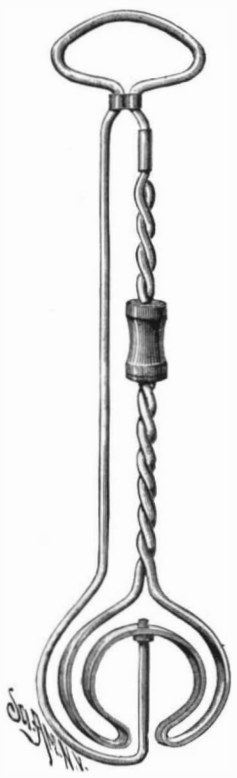
IMPROVED EGG BEATER.

Egg beaters which move continually in the same direction produce poor results, since the semi-liquid mass is carried round but is not agitated; this is remedied in the beater herewith illustrated, as a reverse motion takes place at short intervals. A strong wire is bent to form the frame, the top being provided with a handle loop, and the bottom being bent up to form a pivot. On the free end of the wire at the bottom of the handle is a sleeve which forms a socket for receiving the pointed end of one of two wires twisted spirally together, the lower end being flattened and curved as shown. The twisted wires rest and turn upon the end of the upwardly projecting part of the frame. By working the nut, which is fitted to slide upon the twisted section, up and down the curved portion is rapidly revolved in opposite directions, thereby beating the eggs quickly and thoroughly. The beater is simple and strong, and there are no parts liable to get out of order.



This invention has been patented by Mr. Charles A. Bryant, of Wakefield, Mass.

A Japanese Patent Law.

Determined upon progress, the Japanese have at length passed a patent law. The new law appears to be compiled from similar laws of other countries—a clause from England here, from France there, from Germany in another place, as seemed advisable in the circumstances. The term of protection is 15 years; "articles that tend to disturb social tranquillity, or demoralize customs and fashions, or are injurious to health," and medicines cannot be patented; the inventions must be publicly applied within two years, and patents will become void when the patented articles have been imported from abroad and sold; the fees are low, and there are no annuities or annual payments required for keeping the protection in force, as in many European countries.

IMPROVED KNOCKDOWN FURNITURE.

The object of the invention herewith illustrated is to so construct household furniture—such as bureaus, washstands, sideboards, desks, etc.—that it can be folded very compactly for transportation, and can be erected or taken apart easily and rapidly. The bureau shown in the engraving is made with a skeleton frame on which the other parts are held. The two end pieces are formed with short legs in the usual manner, and are united at the rear by top and bottom bars having grooves along their facing edges for the reception of the panel plates of the back, between which is a post having tenons at its ends to enter the grooves in the bars and having side grooves to receive the panels.

At the front the ends are united by a top rail having notched and tongued ends to fit on the ends of the front uprights and against the ends of cleats on the inner upper surface of the ends. The bottoms of the front of the ends are united by an ornamental rail; tongues on the ends of this rail enter notches in the lower parts of the ends. Two intermediate rails have their ends formed with dovetail tenons that rest against the inner dovetail surfaces of the front uprights. The drawer cleats are L-shaped in cross section, the ends of the upright part of each cleat projecting beyond the ends of the horizontal parts. The front end of each upright part of each cleat is beveled to fit against the rear bevel of the corresponding upright of the ends; the horizontal parts of the front ends of the cleats rest against the back edges of the intermediate rails. The inner ends of the horizontal parts of the cleats abut against L-shaped blocks, secured at the outer edges of the inner surfaces of the back panel plates, and the upright parts rest in the recesses of the blocks.

The top plate is formed with a ledge projecting from the under side of the front edge, and with two undercut L-shaped side ledges. The back edge of the plate is open. The plate is pushed over the skeleton frame from the front toward the rear, the cleats on the outer top edges of the ends passing into the grooves in the undercut ledges, thus holding the top in place and bracing and stiffening the entire frame. Each drawer is provided with a front plate having a vertical dovetail groove in the inner surface a short distance from each end, and a longitudinal groove a short distance above the bottom edge. At the inner side of the front end of each side piece is a strip tongued to slide in the grooves in the front plate. In the inner surface of each side, near the rear end, is a dovetail groove in which the back fits, and along the bottom edge of each side is a groove to receive the bottom. A screw passed through the bottom into the edge of the back holds all the parts firmly in position.

In the back edge of the top plate are two dovetail notches to receive tongues on the mirror frame, the various parts of which are so joined as to be held firmly when assembled, and to be easily taken apart for packing. The principle here employed is the same as that briefly described above in the drawers and body of the bureau. Knockdown boxes may be placed on the top at the base of the mirror frame.

It will be seen that a bureau or like piece of furniture, constructed in this manner, can be quickly erected without the use of screws or glue (where necessary the parts are held together by hooks and eyes or headed studs), and will be solid and strong, all the parts being securely braced and held. Certain of the larger parts are so made as to form, when packed, recesses into which the smaller pieces are placed.

The bureau can be packed in two bundles (shown in the engraving), which occupy less than one-third the space the erected bureau does, thus reducing the expense for transportation or storage; burlap and lumber for packing are also saved.

This invention has been patented by Mr. J. B. Brolaski, of 111 North 6th Street, St. Louis, Mo.

BROLASKI'S IMPROVED KNOCKDOWN FURNITURE.

Improvements in Gelatino-Chloride of Silver Paper.

From some recent experiments detailed in the *Photo. News* by Messrs. W. M. Ashman and R. Offord, it appears that the introduction of a small amount of chloride of gold into the emulsion prior to the coating of the paper materially hastens the toning of the same after development, and reduces the time necessary for toning to a minimum. Emulsions having the gold in must be used within a short time after they are prepared.

It is also advised that a small amount of citrate of soda be added to the toning bath for absorption of the freshly liberated chlorine from the gold.

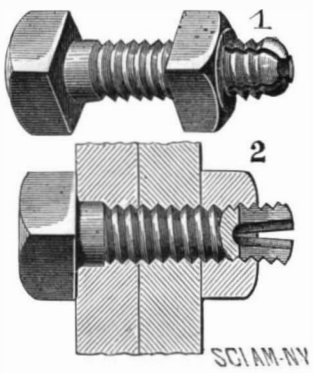
It is very necessary that all traces of free nitrate of silver be thoroughly washed out of the emulsion when it is made.

Manufactures from the Air.

The process of Brin Brothers is about as follows: First, the air is drawn, by means of a partial vacuum, through a vessel of quicklime, which absorbs all the carbonic acid and moisture, and reduces it to a mixture of oxygen and nitrogen. These gases are then drawn into the retorts, heated at 500°, and the artificial lung absorbs the oxygen, while the nitrogen is drawn off to a gasometer for conversion into ammonia, etc. The Brins have, for the first time, made the artificial lung indestructible. The use of baryta for the purpose is not unknown; but hitherto the baryta has been perishable, and has required renewal every four and twenty hours, at great expense. They make it virtually indestructible and unchangeable. In this way they claim to have effected an absolute revolution in chemistry; for with a lung for the machine, and the atmospheric air for the material, they can make just as much oxygen as they like; and its uses, present and prospective, are almost innumerable and incalculable. For ventilation, aerating water without carbonic acid, for increasing the heat of blast furnaces and the light of lamps, its uses are self-evident. The nitrogen, which was at first looked upon as wasted, has, by a process due to the same inventors, been turned into ammoniacal salts for manure. Most of the uses of these products were known. What is claimed is the almost fabulous reduction in the cost of production. The chemical text books, according to Messrs. Brin, are at fault as to the possibilities of baryta. They all teach that it is destructible; and the Brins maintain that, as they know how to treat it, it is indestructible. Oxygen in large quantities means a revolution in half the processes of chemical industries.

IMPROVED NUT LOCK.

The end of the bolt is formed with a smooth recess, and with radial slots extending from the recess to the outer surface of the bolt, as shown in both drawings. The bolt is passed through the plates, and the nut is drawn up tight, when a mandrel or other tool is placed in the recess and struck with a hammer to spread the slitted end of the bolt, whereby the nut is locked in place, as represented in Fig. 2. When very great power is applied to unscrew the nut, the prongs formed by the slits are pressed together, and the nut can be removed.



This invention has been patented by Mr. James H. Comstock, of 2 Equality Park, Newport, R. I.

The Treatment of Sick Headache.

Dr. W. Gill Wylie (*N. Y. Med. Jour.*), of New York, has produced excellent results with the following method of treatment: So soon as the first pain is felt, the patient is to take a pill or capsule containing one grain of inspissated ox gall and one drop of oil of gaultheria, every hour until relief is felt, or until six have been taken.

Dr. Wylie states that sick headache as such is almost invariably cut short by this plan, although some pain of a neuralgic character remains in a few cases.—*Detroit Lancet.*

Distribution of Power by Vacuum.

M. Boudinoot has explained to the members of the French Society of Civil Engineers the details of his establishment in the Rue Beaubourg for supplying power to the small industries of the neighborhood by means of rarefied air. He says that, in comparison with all other means for the distribution of small power, rarefied air is the most economical and serviceable. As contrasted with compressed air, it is more than twice as effective; while the first cost of the plant and the working expenses are much less. In the Rue Beaubourg the mode of action is to create, by suitable pneumatic machines, a vacuum of 75 per cent in the mains and services connected with the subscribers' engines. At present a 70 horse power boiler supplies a Corliss engine, the piston rod of which is prolonged to work the piston of the air pump.

Experience showed that there was considerable heating produced in the air cylinder by the compression which took place when the air, aspirated from the main at one-fourth of the atmospherie pressure, was ejected at the rate of 60 revolutions per minute. To check this effect, water is injected into the air cylinder; this device being preferred to the alternative of a cold water jacket for various reasons, the principal one being that the water jacket would have seriously increased the bulk of the machine, and would only have cooled down the periphery of the cylinder, whereas what was wanted was a cooling of the mass of air contained in it. The distributing system comprises cast iron mains, the largest being 10 inches in diameter, diminishing to 6 inches in the outskirts of the district. The service pipes are of lead; and the loss in distribution is only 3 or 4 per cent. The economical duty of the various classes of simple motors actuated by this exhaust system varies from 40 to 65 per cent, according to size and pattern. The engines are provided with revolution counters, and the charge is based upon the thousands of turns so indicated; the rental being collected every ten days. Up to the present time the system has only been in work during twelve hours every week day; but as the business increases, and larger plant is laid down, it is intended to work until a late hour of the night, in order to adapt the system to electric light engines.

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Correspondence.

Mercury in Louisiana.

To the Editor of the Scientific American:

In No. 20 of the SCIENTIFIC AMERICAN was published a communication from Mr. E. Wilkinson to the *American Journal of Science*, in which he says that native mercury had recently been discovered in a locality where its presence hitherto had been unknown. Cedar Grove plantation, in Jefferson parish, La., on the west bank of the Mississippi, ten miles above New Orleans, was designated as the place where the mercury had appeared in small globules in the alluvial soil. Mr. Wilkinson having examined several specimens of the soil, arrived at the conclusion that the mercury only appeared within a limited area, around a certain center, about 300 feet from the Mississippi River, and for a distance of about 1,200 feet from where the metal disappeared. In none but the upper stratum of that soil did the mercury occur in sufficient quantity to be perceptible to the naked eye. The presence of that mercury, he further says, had been noticed for a number of years, but it had not been officially reported to the scientific world, to his knowledge. He also did not think that the mercury had been wrecked in so large a quantity, or that the results had been effected by the agency of man.

More than ten years ago, I wrote a letter to the Hon. M. Hahn, who at that time was a member of Congress, calling his attention to the mercurial deposits in the valley of the Mississippi. I pointed out to him several facts and localities where I had met with globules of that metal. In three different places of the third district of the city of New Orleans, not far from the river. I had discovered during winter time such metallic globules with the naked eye.

The globules, of a comparatively large size, were dispersed over the surface of the soil. From the existence in the parish of Calcasieu, underneath a big layer of sulphurets, of an apparently inexhaustible mine of sulphur, of a chemical purity unequaled in the whole world, the idea struck me that the mercury I had discovered might have been combined in a former period of our earth's history with another element, and been separated by some reducing process. The wide dispersion of the mercury through the soil from its larger deposits, wherever they may be situated, cannot be wondered at, on account of the metal being a liquid.

Besides my discovery and that of Wilkinson, there is still another one to my knowledge which will prove the existence of larger deposits of that metal. Some time after a conversation I had held with the late Dr. White, then president of the Board of Health, about my discoveries, he brought to me a bulky mass of earth, which he stated had come from Donaldsonville, La. The quantity of mercury apparently contained in it was still larger than I so far had met with. So much seems to be evident, from what has been stated here, that somewhere in our State a large deposit of that valuable metal must exist. It is, then, not improbable that the poorest of the States in regard to mineral riches, a State which but a few years ago could not even contribute a stone to the Washington Monument, may yet become one of the richest; and well worthy, from the diverse indications we so far have received, from its various mineral deposits, that the general Government should order a geological survey of its territory.

M. SCHUPPERT, M.D.

New Orleans, August 1, 1885.

Controlling or Annihilating Tornadoes.

To the Editor of the Scientific American:

More than a year ago I advanced the plan to blow up or annihilate those so fearfully devastating tornadoes or whirlwind storms by explosions of common gunpowder. In your issues of Feb. 2, 1884, etc., short accounts of procedures are given. Some of the details are that a keg or barrel of common powder is to be kept in readiness to the southwest of the house or village to be protected. At the approach of a tornado the powder is wheeled or drawn as near as possible into the probable track of the tornado, by a cool-headed man, who then takes his position to the northwest about one hundred yards distant, fires the powder as artillerists do cannons when the tornado is near or over it.

I did not then state the reason why explosions of powder for such purposes must necessarily be effective, hence many have doubted and none have tried the plan in tornado infested districts. The remedy is for tornadoes or whirlwinds (often surnamed cyclones) of small diameters only, and not at all for proper cyclones, storms of sometimes a hundred or a thousand miles in diameter, moving also generally from west to east. Tornadoes are readily seen in the form of an hourglass or funnel-shaped dust or electrical cloud, advancing at the rate of from 40 or more miles an hour, but rotating on their axis at the rate of probably more than a thousand miles an hour. The width of their track varies greatly, from less than a rod to more than a mile, according to whether the funnel-shaped cloud is high or low. It must be known that all tornadoes have four different movements: 1. Generally from the southwest to northeast. 2. Rotating. 3. Zigzag. 4. Rising and falling. The last movement controlled will insure safety from tornadoes.

When tornadoes rise and fall by themselves, sometimes skipping over one town in their track, and entirely destroying the next, it must be evident that a lift given them by explosions of powder must necessarily make them rise sooner and higher, skipping over longer intervals. The explosions timely repeated must keep them on high, spending their force to no disadvantage to mankind below. Large charges of powder are liable to destroy or annihilate tornadoes altogether. When in districts favorable to the formation of tornadoes, powder is generally kept in large quantities for defense against them; explosions of the same at a distance of a mile or more from them are liable to check or influence the different air currents meeting and forming tornadoes or whirlwinds.

In every village or town of the country there are probably readers of your paper, who are, of course, the most progressive in their places. It becomes them to acquaint their townsmen with this tornado remedy, so promising and easily executed. It may perhaps at no distant day save their all from destruction. Every village or town should have its powder house to the southwest of it, for storage of all its surplus commercial powder. The whole powder house may, when required, be exploded from a dugout near by, artillery fashion, by means of a long cord and priming tube, or by electricity from the highest house in the town, to make the tornado at least jump over the town, if not to annihilate it completely.

JOHN F. SCHULTZ.

New York, July 14, 1885.

Spontaneous Combustion of Lampblack.

To the Editor of the Scientific American:

We have recently had so close a call of having our factory destroyed by one of those mysterious fires, that we deem it worthy of mention, as the circumstances occurred under our personal observation, and seem to us somewhat remarkable. On Wednesday, the 15th inst., at about 4 o'clock P.M., one of our painters used a small quantity of black, shook or poured out of a pound paper of Marten's Germantown lampblack. It was clean and dry, and not to exceed 2 or 3 ounces left in the paper; it was set in its usual place on the paint bench, and in the course of twenty to thirty minutes the men working near the bench detected a smell of burning soot or paint. A search resulted in discovering a slight vapor or smoke arising from the lampblack paper; the foreman brought it directly to the office; it was then but slightly warmer than the hand. We placed it on a board close at hand, and in the course of half to three-quarters of an hour the black was red hot, and soon after six o'clock it burst into a bright flame, which if it had not been noticed would certainly have burned the place, surrounded as it was with mixed paints, oil, turpentine, and varnish. Yours,

JNO. CRETORS & SON,
Buckeye Carriage Works.

Leavenworth, Kan., July 29, 1885.

[It is well known that divided charcoal or carbon when exposed to air of the right temperature and dryness will absorb oxygen so rapidly as to cause spontaneous combustion.—ED.]

The Effect of Scientific Invention on War.

The *Week* (Toronto) of a recent date has the following: There are indeed enthusiasts who fancy that there is a way of putting an end to war at once and forever. Their talisman is the discovery of an all-destroying projectile. An invention of wholesale slaughter thus becomes the dream of the philanthropists, and the infernal powers themselves are to be made ministers of peace. It would be a curious, and for mankind at large might prove an awkward, part of the discovery that it would invest its first possessor with omnipotence, and enable him to compel all nations, on pain of annihilation, to receive him as universal emperor. The London *Spectator*, in a paper discussing this vision at great length, pointed out that the improvement of weapons has so far resulted in a change of drill and tactics, without banishing or even diminishing war. It is certainly curious that the rate of slaughter, instead of keeping pace with the increased range and precision of firearms and artillery, should have remained stationary, as it appears to have done, or rather has diminished. The rifled breechloader does nothing like the execution which was done by the bow. At Crecy the French dead were counted by heralds on the field, and their number exceeded thirty thousand. This was mainly the work of, according to Froissart, five thousand two hundred archers. At Batoche, we are told, nineteen thousand rounds were fired, by good marksmen, besides Gatling ammunition and shells; and the number of killed and wounded on the side of the half-breeds was about thirty. Batoche was not a normal case, it is true, because the enemy were in rifle pits; but still the contrast is striking. The archer was not confused by smoke and noise, nor could he discharge his arrow without drawing the bow to his ear and taking some sort of aim, while many soldiers in a modern battle are said not to bring the rifle to the shoulder or take any aim at all. But we must wait for a great sea fight before we make up our minds what effect scientific invention is likely to produce on war. From naval war at all events all the romance, all the pride, pomp, and circumstance, which largely stimulated the martial spirit, must now have fled. We shall see whether the souls of men are to be fired by the prospect of what Farragut called going to—the nether world—in a tea kettle.

Some Profitable Work for Inventors.

Among the present wants of American railroads is some cheap and effective means of killing weeds and grass that cover the tracks and roadbed on all roads that are not ballasted with rock. Grass is a serious hinderance to ordinary track repairs, and greatly impedes trains by being crushed on the rails and destroying adhesion. This renders it necessary to remove weeds and grass with shovels or implements made for the purpose, either by cutting or digging over the surface of the roadbed. Trackmen are frequently compelled to devote considerable time to removing grass before they can attend to needed repairs, and it is an expensive operation.

It is well known that steam will kill vegetation, and it would not be a difficult matter to arrange a boiler so as to saturate the track or roadbed between, and a proper distance outside the rails, to keep a clean track. Locomotives hauling trains have no steam to spare for the purpose of killing grass, and one that has been retired from regular service might be fitted up to keep a clear track by steaming the roadbed. Something of the kind has been attempted, but the field is open, and is an inviting one for inventors.

What is required is boiler attachments so arranged that the steam may be used effectually and economically, the details of which attachments may be readily worked out by any practical mechanic or engineer.

Other ground that has been partially worked over, and still offers tempting inducements to inventors, is to provide some reliable means of preventing rear collisions of trains. The causes of this class of collisions are various, and the results are usually serious, and to prevent them requires the exercise of a considerable amount of ingenuity, but effective means of preventing this class of accidents are within the reach of American inventors. Darkness, foggy weather, and blinding snow storms render it unsafe to rely on other than audible signals. Disabled trains that are closely followed by others usually fail to signal following trains in time to prevent disaster. Sending back signal men on stormy nights is usually a failure, and mechanical appliances must be resorted to for reliable means of signaling. Explosives in the shape of torpedoes are the most reliable signals, and it is here suggested that a small wire cable may be stretched the entire length of the line, connected at proper intervals with torpedoes, and so arranged that a slight movement of the wire will place an explosive on the rail. Of course the cable must be made in sections, and so arranged that in case of a stalled or otherwise disabled train, or from any cause it is desired to signal a coming train, a man may place the signal in either direction without consuming valuable time in going to a safe distance to place it. This can be accomplished by being provided with a small lever and grip arrangement that will grasp the cable and grip the rail for a fulcrum. By this means a signal may be operated from almost any point with little or no travel and loss of time when even seconds are precious. These sections of cable will need springs or counterweights to return the mechanism back to place when the signal has performed its service. Track men can see that torpedoes are kept ready attached for use in any emergency. Such an appliance can be made to work automatically at railway crossings, switches, and drawbridges. Some expensive signal apparatus is in use at draws, etc., but frequent accidents show them to be unreliable, and inventors will do well to produce simpler, cheaper, and more reliable signal apparatus than is now in use. Accidents at highway crossings continue to be frequent, notwithstanding the various devices that have been put on trial as danger signals. Some of these are considered reliable, but are regarded as too expensive for general adoption. A cheap, simple, and reliable crossing signal is in demand. And there is a rapidly increasing demand for cheap and reliable power brakes specially adapted to freight trains; and those now in use on passenger trains may be greatly simplified and reduced in cost, and other objectionable features removed. Many of the safety railway appliances that have been recently brought out, while they have more or less merit, are objectionable on account of cost, complication, and liability to derangement, expensive repairs, and general inconvenience in every day practice, and several serious accidents within the past two years resulting from failures of the best brakes in use is evidence that more reliable brakes are needed. The present demands of railway traffic call for heavier trains and higher velocities, and a fresh field is opened to inventors, both for producing new safety appliances and improving those now in use.

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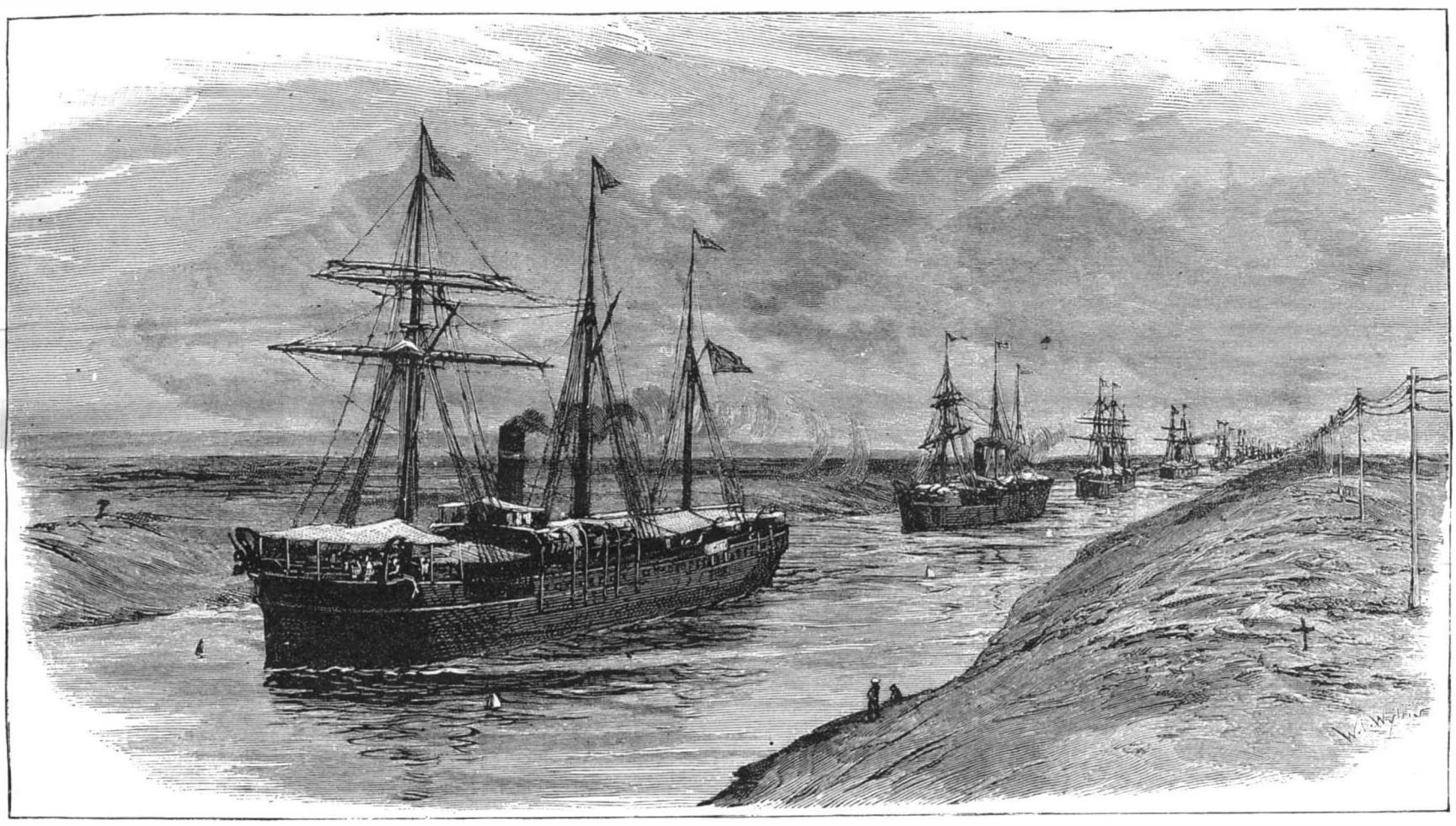
"TRAINS" OF VESSELS ON THE SUEZ CANAL.

Early in June last, the navigation of the Suez Canal was practically stopped by the sinking of a great dredge. An endeavor was made to open a temporary channel around the obstruction, and a few vessels thus got through, but it was not until the 22d of the month that business was fully resumed, after the wreck had been blown up and the debris removed from the bed of the canal. The illustration herewith, for which we are indebted to the London *Graphic*, gives a good idea of the procession of vessels which then began to stream through the canal. Four days before the reopening of the canal, there were one hundred steamers anchored at Port Said, and a corresponding number at Suez. In order that vessels from each terminus may pass each other, the floor channel of the canal being but seventy-two feet wide, with a depth of twenty-five feet, there are several turnouts, in which steamers may anchor at one side of the channel for those proceeding in another direction to pass by, much as trains of cars on a single track railroad are switched off on sidings. These turnouts have been repeatedly enlarged to meet the increasing demands of commerce, as the numbers of vessels traveling together in the same direction have steadily added to the length of the trains, as it were; as a safe distance must be preserved between the vessels of each train, these trains are sometimes as much as two miles long, and the maximum speed allowed is 5·3 knots an hour. To avoid this waiting on sidings, during the current year, and the machines necessary for the completion of the works of the canal have already reached the Isthmus, or are in course of construction. In support of this assertion M. De Lesseps quotes a passage from a report received from the director-general of the works to that effect, and which concludes thus: "It therefore follows that, even if we had only commenced the dry excavation work on the Isthmus on 1st January, 1885, and only begun the dredging work on the 1st January, 1886, the canal could be completed on the 1st January, 1888. To be provided against all possible accidents, there is all the dry excavation work executed before the first January, 1885, and all the dredging which was to be done before the 1st January, 1886." M. De Lesseps goes on to say that there is no doubt that half the effort necessary for the cutting of the canal has already been made. M. De Lesseps says: "The regular continuation of the piercing of the Isthmus, and the completion of the canal in 1888, are the best replies that can be opposed to the adversaries of the canal. We will not do our partners in the work—the shareholders—the injury of supposing that they are moved by such maneuvers."

To show the Panama shareholders that they need feel absolutely no alarm, the president of the company relates how, in 1860, the Suez Canal Company was attacked in precisely the same way. At that time the public was warned against taking up the little shares of the Suez Canal Company. The progress of the works was described as such as to show the impracticability of the enterprise. "It is," says M. De Lesseps, "in precisely similar terms that the Panama Canal is now sometimes spoken of. The little shares of the Suez Canal, issued at 500f., have become big shares of 2,200f. The Egyptian Bosphorus has been created. The little shares and obligations of the Panama Canal will have the same destiny; for the American Bosphorus will be completed, as was its predecessor." Referring to the little mishaps which have occurred, M. De Lesseps says it would have been puerile to imagine that the gigantic work of piercing the Isthmus could be accomplished without any such accidents, and that the execution of each portion of the works could be regulated like clockwork. The number of cubic meters of soil removed every month is steadily increasing. In January, 1885—quoting the report—it was 550,000 cubic meters; in February, 590,000 cubic meters; in March, 627,000; in April, 775,000; in May, 795,000. In April, 1885, there was 17,881 persons occupied on the works; but in October there were 20,368 persons employed on them. Since that time the number of men employed has been maintained at about that figure. The deaths on the works continue very high. The official returns of the deaths that have occurred on the works during the year ending March last are as follows: 1884—April, 59 deaths, of which 9 were Europeans; May, 41 deaths, 3 Europeans; June, 60 deaths, 12 Europeans; July, 87 deaths, 26 Europeans; August, 119 deaths, 35 Europeans; September, 132 deaths, 25 Europeans; October, 163 deaths, 42 Europeans; November, 154 deaths, 48 Europeans; December, 142 deaths, 59 Europeans. 1885—January, 91 deaths, 35 Europeans; February, 46 deaths, 13 Europeans; March, 49 deaths, 21 Europeans—a total of 1,153, and death rate of 51·7 per thousand.

With regard to the insurrection which took place at Colon and Panama in May, it had not entailed any great loss on the company. At the Culebra, where the most serious incident occurred, the loss fell on the contractor. In that chapter of M. De Lesseps's report which is headed "The Cost of the Canal," he explains that his chief engineer has calculated that, by certain modifications, it would be possible to reduce the total number of cubic meters of soil to be removed to construct the canal from 120 millions, the estimate of the Technical Commission, to 90 or 95 million meters. Nevertheless, M. De Lesseps prefers to take the original estimate as the base of his calculation. The contractors now engaged in cutting the canal have undertaken to remove 62,691,595 cubic meters of soil for a total sum of 219,295,974f. Moreover, contracts have been entered into with two other contractors, who have undertaken to complete the remainder of the works for a sum of 480,000,000f. The total cost of the actual piercing of the Isthmus will, therefore, amount to 700,000,000f.—£28,000,000 sterling. To this sum must, of course, be added the cost of the canal administration and the annual interest paid on capital. The International Congress estimated the expenditure for the creation of the canal at 1,070,000,000f., but the company has purchased the Panama Railway and land and provide for the further increase of the canal business, two different projects have been under discussion for a considerable time back; one was the building of another and separate canal by the side of the first, and the other the simple widening of the present canal. The last plan was finally adopted by the "International Commission" of June, 1884, and, at a meeting of the Suez Canal Company, in Paris, on June 4 last, the directors were authorized to borrow $20,000,000 to carry forward the proposed improvement.



THE BLOCK IN THE SUEZ CANAL.—PROCESSION OF STEAMERS AFTER THE RENEWAL OF TRAFFIC.

Official Report on the Panama Canal.

The report which M. De Lesseps read at the annual general meeting of shareholders, in July last, is of length and of interest. M. De Lesseps admits that modifications of detail, necessitated by circumstances, have been introduced into the original programme of the work, but the leading principles of that programme have not been altered. That programme consisted, first, in the cutting of a canal from Panama to Colon, 9 meters deep below the average height of the waters in the two oceans; second, the width of the canal was to be 22 meters at the bottom; third, the canal between the two oceans was not to comprise any tunnel, but to be an open cutting in its entire length; fourth, at Panama a lock was to be established, to prevent the tide creating a swift current in the canal; fifth, in the middle of the course of the canal a long station, or siding, 5 kilometers in extent, was to be created; sixth, at Ha Gamboa an immense dam was to be constructed, so as to intercept the waters of the Rio Chagres, and to give them another course. The execution of this programme has been proceeded with in the vicinity of Colon and Panama. Evidently the company will require an extension of its borrowing powers to cover these expenses, which were not included in the original estimate. At the end of his report, M. De Lesseps says he has demanded of the French Government authority to borrow 600,000,000f., by the issue of bonds with annual prize drawings. Having obtained the approbation of the shareholders, he will take the necessary steps to obtain that authorization.

Durability of Slate when Exposed.

In the Granary Burying Ground, in Boston, there is a stone of slate erected to the memory of Captain William Condy, who died August the 25th, 1685. The style of lettering, position, etc., all indicate that it was put there soon after the burial. Yet every letter is clear and sharp, even the guiding lines, scratched with the chisel, being perfectly distinct. In fact, the stone seems to have suffered no change whatever. There are many others near it in the same unimpaired condition, and of nearly equal age. These slabs, probably, were brought from Quincy. ARTHUR C. KIMBER.

July 15, 1885.

Small Electric Lamps, Etc.

In consequence of the enlargement of business the Stout-Meadowcroft Company has become incorporated, with Mr. Henry V. Parsell as president, a gentleman of well known means and business ability. We have heretofore referred to the excellence and reliability of the electric lights, electric fans, batteries, and other apparatus furnished by this company.

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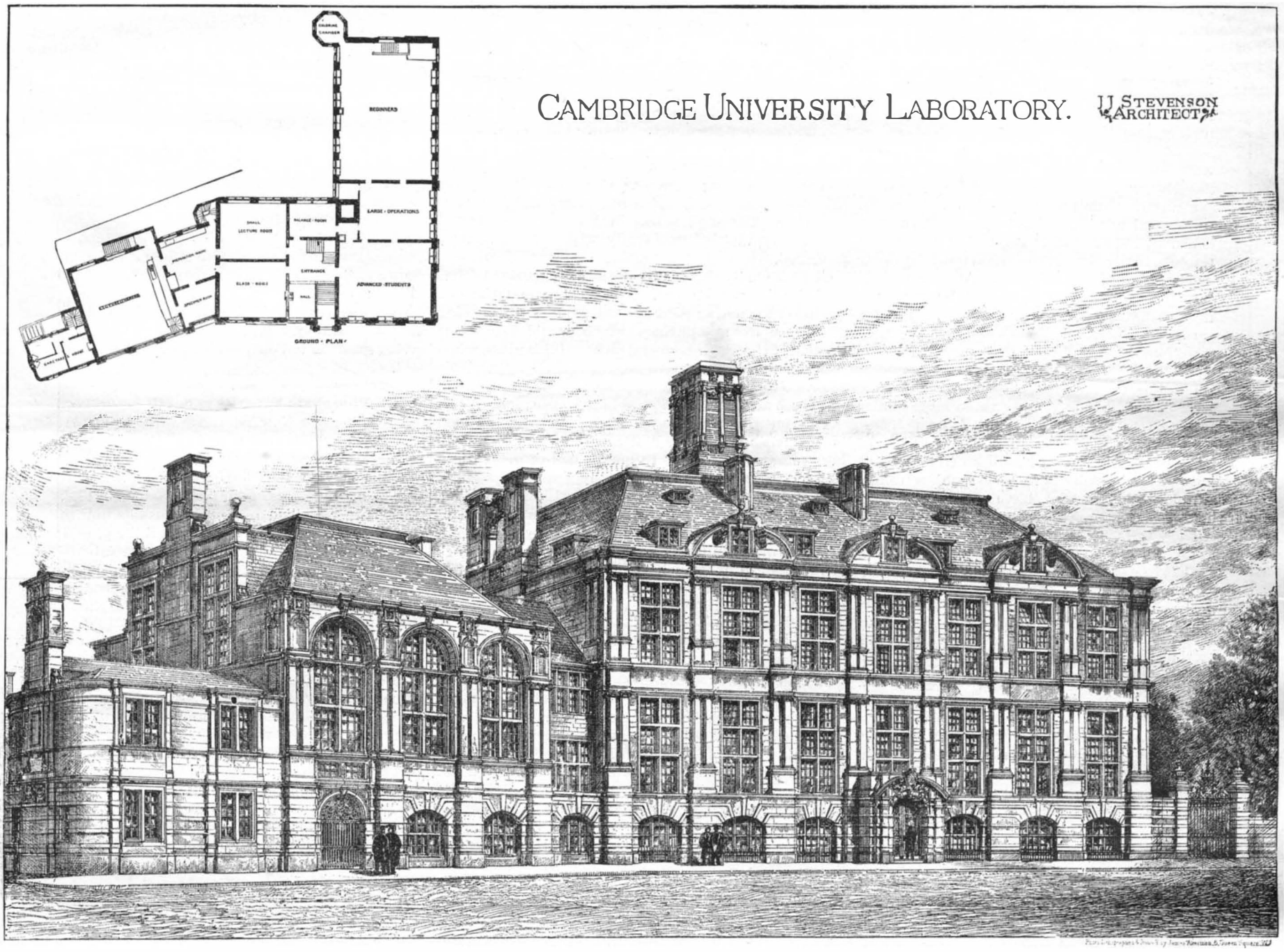
NEW CHEMICAL LABORATORY, CAMBRIDGE UNIVERSITY.

We give this week an illustration of the design for the new Chemical Laboratory of Cambridge University which has been approved by the Senate. The site is in Pembroke Street, opposite the Master's Lodge, and the new building of Pembroke College, on part of the frontage of the old Botanic Garden, and on the site of the Perse Almshouses, now removed, which has recently been acquired by the University for this purpose with the consent of the Charity Commissioners. The remainder of the Botanic Garden frontage to Pembroke Street it is proposed to occupy by the Sedgwick Memorial Museum of Geology. The broken line of frontage has necessitated a corresponding irregularity in the building, which could not have been avoided without loss of valuable space, and which, perhaps, recalls the interest and picturesqueness of old buildings in which such irregularities were not uncommon.

The building consists of a basement well raised out of the ground, occupied by store rooms, engine house, etc., and two smaller laboratories. The main building has two lofty stories above the basement, the central



parts divided into mezzanines. The wing, stretching backward, has one story only above the basement. Provision is made for 150 students working at one time. A second story above this one would give places for 75 more. The principal requirements of a laboratory are ample light and good ventilation. The latter is provided for by the tall chimney or extracting shaft, which, though it carries off the fumes of the furnaces and of the boilers for steam engines and heating, will not, it is hoped, emit any visible smoke, else it might be better without any attempt at architectural ornament. Good lighting is provided by large windows carried square to the ceiling, divided by mullions and transoms with painted wooden sashes and bars, metal being liable to be affected by chemical fumes.

Complicated arrangements for ventilation have been avoided, as being often ineffective and certainly costly. The same large chimney, without any divisions in it, serves for air extractor, ventilator, and for the boiler fires, their heat supplying the necessary motive power, while an extra production of gases from the experiments, which might occasionally occur, is provided for by opening the windows on each side of the room and making a cross draught. A draught closet for operations giving rise to noxious fumes, formed of glazed framework, is provided in each window, with a flue in the wall in which the draught is stimulated by a gas jet, and larger "stink closets" are provided beside the chimney and in the turret at the angle of the large laboratory. This laboratory has been long in contemplation, and the best arrangements for it been studied and worked out by Professors Liveing and Dewar. The principal English and Continental laboratories recently erected have been visited, and their arrangements laid under contribution, with the view of adopting those which have proved successful in practice. The style of architecture adopted is the form of Classic with mullioned windows characteristic of some of the old Cambridge buildings, such as St. Katherine's Hall and the third court of St. John's College, which, while continuing Cambridge traditions, is well suited for the purposes of the building. The view from which our illustration was taken is in the Royal Academy Exhibition this year. Mr. John J. Stevenson is the architect.—*Building News.*

The Post Office in Japan.

In no country of the world is the postal organization more wonderful than in Japan—the chief marvel being that, till about a dozen years ago, there was no regular government institution of posts in the country. In 1871, when Japan awakened like a giant from her long sleep of exclusiveness, and set to work to accomplish changes of every sort, she resolved to establish the European postal system; and with such astonishing zeal has she done her work that within ten years the British, American, and French post offices, which had been established at all the open ports, were closed. foreign nations being satisfied with the thoroughness of the Japanese postal system. In that short period mail routes had been organized over 36,000 miles; mail trains and steamers, post vans, and runners were all enlisted; 3,927 post offices and 7,439 letter boxes had been established; money order offices and post office savings banks were in full operation; 7,500 persons were employed on the regular staff; stamps, stamped envelopes, post cards, and newspaper wrappers were issued at the same rate as our own, letter postage to any part of the empire being at the rate of 1d., and post cards ½d., while within the limits of the city of Tokio these postages are respectively only half price. Where the post office had thus started at full swing it is needless to say that the telegraph was not forgotten, and by 1880 it was in full working order over a distance of about 10,000 miles, and giving employment to about 15,000 persons.—*Cassell's Family Magazine.*

The Health of College Girls.

The investigations which have been conducted by the Massachusetts Bureau of Labor have resulted in some interesting facts regarding the health of female students. The commonly accepted opinion that mental labor, if at all severe or long continued, is prejudicial to health, is here refuted by statistics derived from various sources.

In one case, of 705 returns made, it was found that 78 per cent of the women graduates heard from were in good health. Upon entering college, the health of 20 per cent was below par. After graduation, impaired health was found in only 17 per cent, showing that the physical condition of the student became improved under the restrictions and requirements of college life.

Those whose health was not good suffered chiefly from nervous diseases. It was also found that girls from the country do not make as good a showing as regards health as those who were natives of cities. Although these statistics are looked upon by the advocates of higher education of women as conclusive evidence, we cannot admit that they are sufficiently large or complete to convey much weight. The variation in physical condition, before and after the acquirement of a collegiate education, was only 3 per cent. This fact, which is the one from which any conclusion can be drawn, might be the result of improved hygienic surroundings, both mental and physical, making the effect of study itself wholly negative in character.—*N. E. Medical Monthly.*

Removal of Incrustations from Water Mains by Dilute Acids and Soda.

A successful attempt was made last year in Leipzig to remove by chemical means the incrustation that coated the interior of the force main from the pumping station to the reservoir. The main is 390 millimeters wide (about 15⅓ inches) and 4·55 kilometers long, and the incrustation was from 13 to 24 millimeters thick, and in places thicker still. The operations lasted from the 7th of March to the 11th of May, and during that period at intervals the pipe was filled with dilute hydrochloric acid eight times, with soda solution three times, and with a solution of chloride of lime once, being washed out thoroughly with water between the successive applications. It was stated that the incrustation was entirely removed, and the practical effect of the cleaning was indicated by the pressure gauge, there being a decrease of from 1·8 to 2 atmospheres pressure at pumps.

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The Manufacture of Plate Glass by Natural Gas.

The expression "French plate glass" leads one to think that foreign nations make all of this kind of glass. That is far from being the fact. There are in the United States four works for making plate glass. One is located at New Albany, Ind., one at Jefferson, Ind., one at Crystal City, Mo., and the one described in this paper at Creighton, Pa. Plate glass is made by casting and afterward polishing. The pots in which the materials are melted and the glass made are of great capacity, and require heavy and convenient machinery for pouring. The casting is done on a heavy metal slab, larger than the largest sheet of glass produced, and this slab rests on a car which runs on tracks leading from the melting furnaces to the annealing rooms. A large iron roller, running on strips of iron at each side of this table, presses the molten glass into a sheet as the workmen pour it in front of the moving roller. The thickness of these strips of iron, on which the roller rolls, determines the thickness of the plate of glass. While the glass is yet hot it is thrust into an annealing oven, where the temperature is gradually lowered for several days until it is cold. The surface of the glass is now very rough and uneven, and, though it is translucent, it is not transparent. In this form it is used for skylights, and for places where strength and light are required without transparency. After the plate comes from the oven, it is firmly fixed upon a large rotating table or platform, which revolves quite rapidly. Over its surface two disks rotate and revolve in such a manner that they cover the entire surface of the glass at each rotation of the platform. The attending workmen throw common river sand upon the surface of the glass, which is kept constantly wet by small streams of water. This process grinds off the rough exterior, after which it is ground with emery, on machines of similar construction. Beginning with coarse emery, they gradually change the grade until the finest powder is used to finish the grinding. After the grinding is complete, the surface is polished by rouge on machines constructed on the very best principles for making perfect surfaces.

From the time the glass leaves the annealing ovens until it is perfectly polished, the workmen examine it, from time to time, for any flaws, bubbles, or defects, as grains of annulled sand. Only those large plates which are free from defects of any kind are polished entire. When a flaw is discovered in a large plate of glass, the plate is cut into smaller ones of marketable dimensions. This branch of the trade requires trained and skillful workmen who have good judgment. After the glass has been properly polished and cut into required sizes, it is boxed ready for shipment. The manufacturers insure large plates of glass, for which the buyer has to pay. This makes the purchase without risk to the purchaser.

The works of the "Pittsburg Plate Glass Company" are located at Creighton, about twenty miles above Pittsburg on the west bank of the Allegheny River. There are about eight or nine acres covered with buildings, along a side track of the West Pennsylvania R. R., which are used for the various purposes of manufacture, storehouses, furnaces, casting houses, stables, offices, etc. One of the buildings, 650 feet long by 160 feet wide, is the casting house. It contains sixty ovens for annealing glass and two furnaces for melting. Each annealing furnace is over forty feet long by nearly twenty in width. Each melting furnace contains fourteen pots. The apparatus for casting consists of two iron tables, seven inches thick and 19 feet long by 14 feet wide; two iron rollers, thirty inches in diameter and 15 feet long. These tables are on carriages which move on a track which reaches every furnace, and is nearly one mile in aggregate length. There are also cranes, tongs, ladles, and pulleys, which are most conveniently arranged for rapid work. The first building in which the plates of glass meet machinery driven by steam is the grinding house. This building is over 200 feet long by 80 feet wide. There are eight rotary grinding machines in this building. Each machine requires forty horse power, and all are driven by two double vertical engines. There is a second grinding department, which contains two machines of the latest French pattern. These machines require one hundred and twenty horse power, and do most excellent work rapidly.

The glass is smoothed in a building about 100 feet by 200 feet. In this house there are twenty smoothing machines, which require the power of two engines of forty horse power each to drive them. Next in order is the polishing house. This is the same in size as the smoothing house. There are sixteen polishing machines, each eleven by twenty feet, driven by two engines of over eight hundred horse power.

The company make their own melting pots, and in this building a steam engine of thirty horse power grinds and mixes clay. There is a department where plate glass mirrors are made, and this requires the help of a large engine to drive machinery for beveling the edges of plates of glass. This department has proved a perfect success, and many beautiful mirrors are made here, ranging in price from $1 to $500.

There is also a large foundry and machine shop, where all the machines used in the "plant" are made or repaired; and a shop for making boxes, where an engine runs saws and planers. The company employs three hundred and forty-five men, forty-five boys, and fifteen women and girls. They have lately built a steam dredge for collecting sand from the bottom of the river for grinding glass. Three million bushels of sand are required each year for grinding purposes alone. The white sand from which the glass is made is shipped from McVeytown, Pa. The amount of glass cast each month is 95,000 square feet. About 3 per cent of this is used for skylights; the rest is polished, making an output of 70,000 feet of polished glass per month, after allowance is made for cutting and breakage.

The novel feature about these vast works—where engines aggregating nearly 1,500 horse power are fed by steam, and sixty annealing ovens and two melting furnaces require fuel—is the entire absence of coal and the use of natural gas in its stead.

The company owns two gas wells, which are about 1,150 feet deep, and they are now running their entire works with a little over one-half the production of one well. The pressure at the well is 260 pounds per square inch. This pressure is reduced at the well to 120 pounds, and, as the line works wide open, the pressure in the regulator, at the works, is lowered to 80 pounds. The pressure is still further reduced before it enters the furnaces. The pipe which conveys the gas to the works is four inches in diameter. The surplus gas is used in the town for heating and lighting, and as they are able to consume but a small quantity of this, compared with the supply, a tube, high in the air, sends out a large flame which lights up the surrounding country. For domestic purposes this fuel has no equal, and it has no superior for manufacturing. The steel works in Pittsburg use natural gas entirely, melting steel easily with the intense heat produced.

Glass made by this fuel is decidedly superior to that made by the use of coal. No coloring material can get into the melting pots, and the flame of the burning gas is free from impurities which would injure the quality of the glass. Several inches of this glass, when seen through from edge to edge, show no appreciable color. This is the most apparent advantage gained, but there are others of no less importance.

The control which the workmen have over the heat in the melting furnaces, and especially in the annealing ovens, enables them to make glass of great durability and strength.

At present the company are in a flourishing condition, and have all they can do to supply the demand for goods. They make glass cheaper than any other plant in this country, and can compete with either the French or the English, inasmuch as their fuel costs them practically nothing; the gas used taking the place of three thousand bushels of coal per day.

How to Make a Glycerine Barometer.

BY J. ASHER.

In 1876 I improved Babinet's barometer by substituting glycerine for water. It is constructed in the following manner: A bottle about a quarter filled with glycerine, colored red with magenta or crimson aniline, has a glass tube of about the diameter of a pencil passing airtight through the cork, which is inserted airtight into the bottle. The lower end of the tube dips beneath the surface of the glycerine. The bottle is made to contain compressed air by blowing into the upper end of the tube. On removing the mouth, part of the glycerine will rise in the tube until the weight of the liquid column in the tube and the atmosphere balance the internal air pressure on the surface of the glycerine. The column in the tube will tend to rise when the pressure of the atmosphere diminishes or the temperature of the compressed air rises, and to fall when the atmospheric pressure increases or the temperature of the compressed air diminishes. So far as the variation in the height of the column is due to changes in atmospheric pressure, the column moves in the opposite direction from that in a mercurial barometer.

It will now be seen that it is desirable to eliminate from the reading of the barometer scale the effect due to a change in temperature. I simultaneously observe the reading of my barometer and a thermometer at hand. I next find the difference between the readings, calling that of the thermometer the minuend. The difference is regarded as the relative pressure of the atmosphere at the time of observation. The divisions on my instrument are one-fourth of an inch apart, and the length of the tube above the bottle is 25 inches. It seems better to have 100 divisions than any other number. These divisions bear no relation to those on mercurial and aneroid barometers. Each instrument is intended to be compared with itself to indicate a relative pressure of the atmosphere. In my instrument the degrees are marked and numbered with a pen on a strip of paper obtained from a ribbon roll; this is pasted upon a neat wooden case behind the tube. The case has a recess into which the bottle is let. A neat piece of wood, of the proper shape, secures the bottle, while leaving it almost entirely in view. Two small wire staples secure the tube to the scale. If desirable, a paper scale may be pasted upon the tube, thus dispensing with a case.

Of course, it is liable to be broken when thus constructed. The use of a thermometer is scarcely necessary if the barometer is kept in a cellar or any place where the temperature is nearly uniform.

With a tube 3 or 4 feet long, the bottle may be buried in a large box of dry sawdust, or any other poor conductor of heat, in a finely divided state. The instrument will then give fair results without using either a thermometer or a cellar.

The advantage of using glycerine instead of water, as used by the French scientist Babinet, is that glycerine scarcely evaporates; besides, it will not freeze except at a very low temperature, and if a minute quantity of water be present, it never becomes solid.

A thin glass tube, 4 feet long, can be bought for 10 cents at the drug stores in cities. The glycerine and magenta will cost less than 5 cents. By making an ornamental case one may, with a little ingenuity, produce a beautiful instrument. It will foretell fair, changeable, and stormy weather as well as a mercurial barometer costing thirty times as much. One evening I noticed that the column of glycerine had risen about three inches within a few hours, not a cloud was to be seen, and the day had been very fine. Next morning there was a heavy rain.

The upper end of the tube should be loosely filled with cotton to keep out the dust. After having forced air into the instrument, it should not be allowed to approach a horizontal position, for the compressed air may blow the column out of the tube; if this does not happen, a large air bubble may separate the column, and render the instrument useless. No particular dimensions are requisite for either the bottle or the tube. My bottle is about 4 inches long and an inch square. The magenta is used merely to render the column more readly visible. Other colors may be used, but this is the most beautiful.

Were farmers provided with these simple and useful instruments, they would most likely be the means of saving grain in harvest, as storms could often be foretold.

Phosphate Deposits of South Carolina.

A member of a New York firm who has just received an order for dredges for use in excavating phosphate in South Carolina reports that industry as especially prosperous, and that 500,000 tons of this material is now being dug up as against 350,000 tons in 1883. The phosphate rock bed of South Carolina now supplies the world with the chief part of all the phosphate of lime used in the manufacture of commercial fertilizers, and this industry was unknown there until 1868. The greatest length of this phosphate rock bed is about seventy miles and its greatest width about thirty miles, the city of Charleston being about the center of the most accessible deposits. It crops out at the surface in many places, and is found distributed over large areas at the bottom of many of the rivers. It is mined in three ways—by open quarrying and digging in the land; by dredging and grappling with powerful steam machines in deep water; by hand picking and with tongs in shallow streams. Its average price is about $6 a ton, and the State levies a tax of one dollar a ton on all that is shipped, making it an important item of revenue. These phosphates are the remains of a very ancient animal life, and fragments are brought up not only representing the tapir, horse, elephant, and mastodon, but amphibious ones, such as the seal, dugong, walrus, etc.

A 500 Pound Pressure Engine.

On July 21 the screw yacht Salamander, which has just been built by Messrs. Schlesinger, Davis & Co., of Wallsend-on-Tyne, proceeded to sea for a preliminary trial trip. The dimensions of the yacht are as follows: Length, 120 feet; breadth, 20 feet; depth, 10 feet 6 inches; tonnage, 211 y.m. She has a sharp clipper stem, with an enlarged salamander for a figurehead, and a square yacht stern. A long deck house is placed amidships, containing a deck saloon, and forward is another saloon, which will be arranged for the accommodation of ladies. The engines are of the Perkins triple-expansion type, working at a pressure of 500 pounds per square inch. The cylinders are 7¾ inches, 15$\frac{13}{16}$ inches, and 22⅞ inches diameter, by 15 inches stroke, and will work at about 140 revolutions per minute. After several trials on the mile the average speed obtained was nearly nine knots per hour. The yacht has been built to the order of Mr. Frederick Power, of London.

Paper for Wrapping up Silver.

Six parts of caustic soda are dissolved in water until the hydrometer shows 20° B. To this solution are added four parts of oxide of zinc, and boiled until dissolved. Sufficient water must next be added to reduce the solution to 10° B. Next dip paper or calico into this solution and dry. This wrapping will very effectually preserve silver articles from being blackened by sulphureted hydrogen, which, as is well known, is contained in the atmosphere of all large cities.

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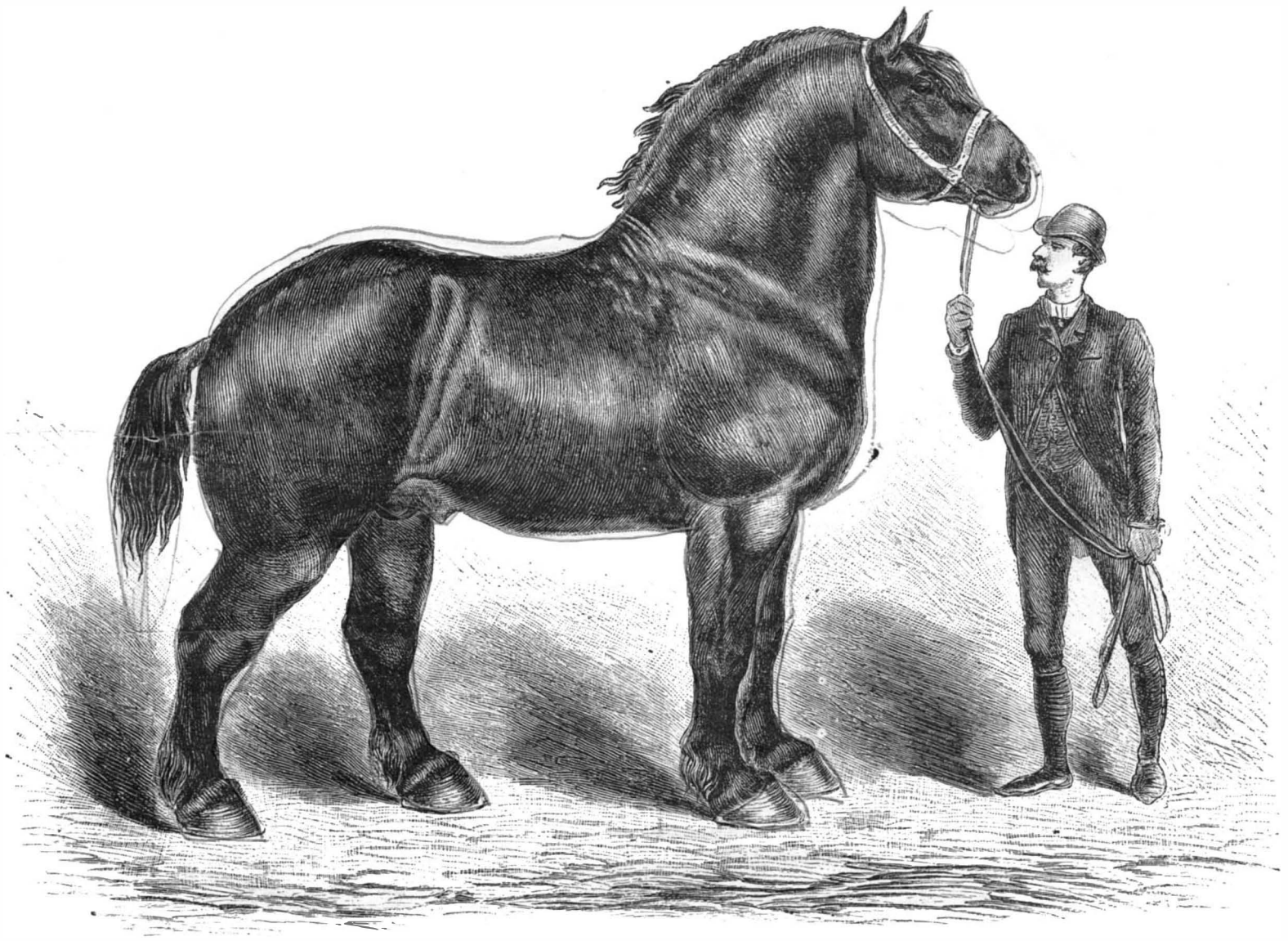
Scientia.

A new scientific association, comprising a small number of very distinguished members, has been formed in Paris under the name of "Scientia." The object of the association is primarily the promotion of scientific knowledge, but the members have taken advantage of the present smallness of their number to give to their meetings something of a social character, and enliven them with a dinner, at which, as with many clubs which meet only occasionally, some eminent person is usually present as a guest. At the last of these meetings, as we learn from *Le Genie Civil*, the guest of the evening was General de Nansouty, the originator of the plan for establishing an observatory on the top of the Pic du Midi, about which we have already had something to say. This mountain constitutes a somewhat isolated spur of the Pyrenees, and rises to a height of more than seven thousand feet above the sea. Although not high enough to reach the limit of perpetual snow, the top of the Pic du Midi is exposed to terrible winds, and in winter is buried in snows which make the ascent to it impracticable.

Nevertheless General de Nansouty, who had been strongly impressed with the value of the mountain, commanding, as it does, the great southern plain of France, as a site for a meteorological station, resolved to attempt a thing that the mountaineers said was impossible, and to pass a winter in a hut at the very summit of the peak. He collected materials, and during the summer constructed a little cabin, which he stocked with provisions and instruments, and put in communication with the outer world by means of a telegraph wire. Before the winter fairly set in, he established himself in his little hut, and there, cut off by the snow from either rescue or retreat, he stayed until spring opened again the way down to the plain. In spite of cold, hunger, and loneliness, he pursued his observations and kept his records, fortifying himself under adversity, as M. Tissandier said in introducing him to the club, by remembering that he was a soldier, bound by his profession not to yield to any force which he had not tried his strength against and found irresistible. Like a soldier, too, the General remembered, through all his privations, to gain what advantage he could for the benefit of the poor people about him, and used his telegraph to send word to the farmers on the plains when the melting of the snow on the peak showed an inundation would soon follow below. After a few winters spent in this manner, a permanent and well-equipped station was, as our readers know, built in place of the little cabin, and a staff of observers established there; and within a short time M. Raphael Bischoffsheim has promised to build an astronomical observatory by the side of the meteorological station. If this promise is carried out, the astronomical observatory of the Pic du Midi will probably soon become as useful to science in its own way as the meteorological observatory. The experience of every year shows more clearly the advantages of placing astronomical observatories, particularly those equipped with powerful telescopes, on the tops of mountains. The one thing essential to the use of high powers in the telescope is a clear atmosphere, and, pure as we think our atmosphere is in clear nights, its transparency is so far inferior to that of the air about mountain tops that, seen from the latter, the atmosphere of the plain always appears filled with haze, which certain conditions of sunlight show to be due to perpetual clouds of dust, kept by gravitation in the lower regions of the air.—*American Architect.*

A BELGIAN HORSE.

Admirers of the paintings of Rubens and other Dutch masters are astonished at the peculiar shape of some of the horses represented, and attribute it to the fancy or peculiarity of the painters. This is by no means the case, for these masters only painted true and exact pictures of the horses of their country, one of which is shown in the annexed cut, taken from the *Illustrirte Zeitung*. The horse represented in the cut was raised in Belgium by a peasant, and lately imported into Germany. This horse is about 6 feet high, and weighs 1,800 pounds. It is said to be the strongest horse in the world, but we have no particulars of his performances. Notwithstanding its size and weight, it can be used very well for carting, pulling heavy loads, etc., and is more active than might be expected.



THE STRONGEST HORSE IN THE WORLD.

About 25,000 horses are exported yearly from Belgium, most of which are raised by small farmers.

Two Singular Lunatics.

The Morristown *Jerseyman* tells of a lunatic at the Morris Plains Asylum who was mute for five years. Even the physcians thought he had lost the power of speech. One day two of his fingers were mangled in a washing machine. To the astonishment of everybody who heard him he exclaimed: "By the great and jumping Moses, a devil is better than an inventor." That was three years ago, and he has not spoken since. Another patient, a boy in the same institution, is a lightning calculator. The most intricate problems are solved by him in fractions of a minute. The boy believes that his head is filled with little blocks with figures upon them, and they instantly fall into different positions and work out the problems. He thinks his brain, in fact, is a multiplication table. His insanity seems pardonable, for only a few sane men can compete with him as a mathematician. Every day he soaks his head in water to prevent the blocks from rattling, and occasionally he begs for oil to put into his ears, so that the imaginary squares will slip upon each other more easily.

Oleomargarine Legislation.

Certain farmers and buttermen in New York succeeded in getting a law passed in 1884 designed to suppress the manufacture of oleomargarine. Sec. 6 reads as follows:

Sec. 6.—"No person shall manufacture out of any oleaginous substance or substances, or any compound of the same, other than that produced from unadulterated milk, or of cream from the same, any article designed to take the place of butter or cheese produced from pure, unadulterated milk or cream of the same, or shall sell, or offer for sale, the same as an article of food. This provision shall not apply to pure skim milk cheese, made from pure skim milk."

It was provided that the violator of this section should be punished by a fine of not less than $100 nor more than $500, or not less than six months or more than one year's imprisonment, or both such fine and imprisonment, for the first offense, and by imprisonment for one year for each subsequent offense.

The court of appeals, the court of highest resort, decided, June 16, 1885, that the law attempted to prohibit the sale of any articles intended to take the place of butter, thus preventing competition and placing a ban upon progress and invention; that invaded the rights both of persons and property, guaranteed by the constitution; that the sale of a substitute for any article of manufacture is a legitimate business, which, if carried on without deception, cannot be arbitrarily suppressed; and that the act in question was not aimed at deception, but went further, and created a monopoly destructive of rights protected by the constitution both of the State and of the United States. In effect, the decision declared lawful the manufacture and sale of oleomargarine when it is offered in market under its true name, and not as an adulterated form of butter, and when it is shown to be composed of pure ingredients.

Artesian Well in Moscow.

This well was opened on the 1st of January, 1885. Boring was begun in 1865, but in 1871 the boring tool broke at the depth of 1,512 feet, and all efforts to extricate it were useless. In 1876 the work was abandoned. In the mean time, however, the water filled the bore to within 40 feet of the surface, and as it was found that this height remained constant, a new plan was adopted. A gallery was excavated from the bank of the Jaonsa River to the well at a level low enough to permit the water to run into a reservoir at the other end. The gallery runs through limestone strata, is 1,400 feet long, and has a fall of 4½ feet. The water is pure, cold (8° R.), and flows abundantly, the daily supply being 770,500 gallons; this is nearly half the whole quantity of water supplied to the city of Moscow. This well ranks among the largest in Europe.

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ENGINEERING INVENTIONS.

A car axle lubricator has been patented by Messrs. William H. Sterling and Dyson D. Wass, of New York city. This invention consists in a spring wire frame of novel construction, carrying oiling rollers intended to give a constant and uniform lubrication of the journals of car and other axles by devices that can be readily inserted into and removed from the box.

An electric grip for railways has been patented by Mr. John C. Henderson, of New York city. This invention consists in a novel combination of adjustable gripping and contact making devices and conducting bars or rails, combined within a longitudinally slotted box or tube arranged between the rails of the track, and is an improvement on a former patented invention of the same inventor.

A car coupling tool has been patented by Mr. Edward A. Hamilton, of New Bethlehem, Pa. It is an implement for holding up the free ends of car coupling links, so train men can do the coupling without going between the cars, and consists of a link holder with arms held to a shank adapted to slide along the handle, but which may be set, and a spring to draw the arms backward from between the drawheads.

A means for coaling locomotives has been patented by Mr. Henry McLaughlin, of Bangor, Me. It consists of an elevated track crossing the track on which the locomotives run, and tracks leading to the coal heaps, a traveling derrick frame running on the elevated track, provided with a hoisting apparatus, making an advantageous combination of tracks, ways, cars, cranes, etc.

A feed water heater and purifier has been patented by Mr. Dyson D. Wass, of San Francisco, Cal. The heater is suspended in the boiler above the water level, with a feed pipe dividing into two branches, each with a cluck valve, an extension of the feed pipe attached to one of the branches, and a blow off pipe and valve, so that impurities will be delivered at any desired point of the boiler, and to scour and clean the heater by water contained in the boiler.

AGRICULTURAL INVENTIONS.

A plow and cultivator has been patented by Mr. Robert M. Henderson, of Leesville, Ind. This invention relates to plows used by corn growers, in which the driver's seat is supported forward near the team, while the weight of the driver is almost entirely removed from the necks of the team, with various other novel features of construction and arrangement of parts.

An adjusting mechanism for harvesters has been patented by Mr. Newton W. Miller, of Marshall, Ind. Combined with a drive wheel and hollow axle is a shaft working therein, a guide plate and bearing carrying a sliding bar, with other novel features, to facilitate the vertical adjustment of harvesters and other machines mounted upon wheels.

A corn harvester has been patented by Mr. Samuel H. Young, of Bankston, Iowa. This invention covers a construction to facilitate guiding the machine along a row of corn hills, so the front of the machine can be readily adjusted to the height of the corn, so fallen stalks will be raised, and whereby bunches of stalks are drawn against the dividers, with other novel features.

A cutting apparatus for mowers and reapers has been patented by Mr. Luman Rundell, of New Baltimore, N. Y. The cutting teeth throughout one-half the length of the cutter bar, when moving in either direction, are, by this invention, made to complete or nearly complete their cut before the cutting teeth on the other half of the bar come into cutting position with the fingers or guards, thus dividing up and easing the cut to reduce shock and jerk.

MISCELLANEOUS INVENTIONS.

A device for handling boxes has been patented by Mr. Alfred Ayer, of Lake Weir, Fla. Combined with two side bars are clamps pivoted to their ends, with a strap uniting the clamps, making a device especially applicable to the handling of orange and lemon boxes, and other such packages too cheaply constructed to have handles.

A horse block or step has been patented by Mr. Martin B. Duncan, of Angelica, N. Y. The framework upon which the treads of the steps are mounted is formed of hollow tubes or pipes, united by T and elbow couplings, the uprights being fastened in buried anchor blocks, the whole making a cheap and durable device.

A plane guide has been patented by Mr. William W. Preston, of Coldwater, Mich. This invention provides an improved guide for attachment to planes to enable the edges of lumber to be squared or beveled at any desired angle either way by the planes, with accuracy, and without the aid of a try square or bevel.

A fastening for blind slats has been patented by Mr. George F. Evans, of Corpus Christi, Tex. It consists of brackets adapted to be secured to the lower rail of the blind and to receive the slat rod between them, together with a binding screw projecting through one of the brackets, to hold the slats more or less open or closed as desired.

A tree ladder has been patented by Mr. James M. Cunning, of Haskins, Ohio. Combined with upright bars are top bars hinged to the upper ends of the uprights, and having hooks projecting from the bottom edges, with braces so pivoted that the ladder can be swung around a tree, and the outer ends of the branches reached thereby.

An ice cream freezer has been patented by Mr. Albert L. Platt, of Bowling Green, Mo. The freezing cylinder has a hollow trunnion fitted to admit the refrigerant, and having a hopper supported on and revolving with the trunnion, with other novel features to facilitate quick freezing, and convenient for taking apart for repairing, replacing, and cleansing.

A wagon standard has been patented by Mr. Jeffrey Starmer, of Levering, Ohio. It is a removable bolster standard or stake for wagons or sleds, consisting of a novel construction of locking device and catch, the standard being quickly and easily attached to and removed from the bolster, staying firmly in place when locked, and being cheaply made.

A cutter head has been patented by Mr. Benjamin R. Hand, of Camden, N. J. This invention relates to wood planing machinery in which the knives are held by a revolving head operating in connection with the mechanism for moving the material to be planed, and is intended to provide a cutter head which will firmly hold the knives after their adjustment.

A necktie fastening has been patented by Mr. Benjamin F. Hutches, Jr., of Galveston, Texas. Combined with an apertured collar button is a disk with a spring loop, the disk being adapted to be secured to the back of the cravat shield with a loop projecting through an aperture in the same, making a device to be used in place of the elastic loop and other means.

A stack cover has been patented by Mr. Albert Cooley, of Osceola, Iowa. It consists of sections with projecting cross bars, bars on adjacent sections being at different distances, and the sections having edge notches to receive locking bars, so the cover may be put on and taken off in sections, and may be extended to any desired length.

A coal hoisting machine or dredge has been patented by Mr. Bernard M. Munn, of Elizabeth, N. J. The machine has a drum, cable, boom, and means for revolving the drum, in combination with vertically movable plates, arms, and scoops, the whole so arranged as to facilitate the handling of coal or other material without the use of shovels.

A faucet has been patented by Mr. Frank F. Wolff, of New York city. Combined with a bushing adapted to be held in a barrel or cask head is a valve for closing the outer end and a plate for closing the inner end of the bushing, or a tube held on the same, both the valve and plate being held on the same spindle, the device being intended to facilitate the drawing of liquids from casks or barrels.

A fanning mill sieve has been patented by Mr. Siver J. Aasen, of Republican, Dakota Ter. The construction is such that fine seeds are deposited in a receiving box under the sieve, and larger seeds, such as buckwheat, cockle, oats, etc., slide down over the sieve into a suitable box, making possible the separation of the seed into four lots of different sizes, while thoroughly cleaning the seed.

A dental jaw brace has been patented by Mr. Willis J. Bickford, of North Attleborough, Mass. This is a device for keeping the mouth of a patient open when gas is administered, and consists of a tube inclosing a spiral spring on the end of which is a slide spring to force and hold the mouth open, the prop thus formed being properly cushioned at top and bottom.

A canal convoy has been patented by Mr. William F. Cowden, of Cumberland, Md. This invention covers novel constructions and combinations so the convoy may be allowed to drop some distance astern, means for maintaining a given distance between the boats, and means whereby the separating device may be disengaged and the boats drawn close together for passing through locks.

A sash holder has been patented by Mr. Henry Staib, of Jeffersonville, N. Y. A face plate is formed with side flanges having spindle perforations and recesses on their inner faces extending from the face plate to the perforations, with eccentric, removable spindle, and other novel features, making a simple mechanism for supporting and locking window sashes in any desired position.

An oil strainer has been patented by Mr. William Connolly, of South Norwalk, Conn. It is made with an outer case and one or more filtering chambers with perforated side walls, and an imperforate bottom tapering downward, the device being especially intended for use in connection with the oil drip pans for sewing machines formerly patented by the same inventor.

A machine for cleaning and repairing roller skates has been patented by Mr. Rufus F. Hull, of Fonda, Iowa. It has a rotary shaft with a pair of wheels having a space between them equal to the distance between a pair of skate wheels, the wheels having inclined grooves whereby the rollers may be cleaned and evened, while there are chucks, abrading disk, and drill, for leveling, reboring, and repairing.

An automatic swinging chair has been patented by Mr. John C. McMullen, of St. Augustine, Pa. By this invention the lever through which the chair is moved is not connected with the supporting hangers of the chair, being thereby freed from the weight of the operator and giving a greater movement to the chair, so the occupant can originate and easily maintain a continuous swinging motion.

A chain saw has been patented by Mr. Walter S. Shipe, of Minerva, Ohio. Each link of the chain is made to displace the whole chip, and effect a ready clearance, which is done by a single cutter of peculiar construction applied to each link, the saw, in cutting logs or felling trees, being started by placing its front end partially around the tree or log, and then drawing the chain over the timber.

A door has been patented by Mr. Jeuleos Gamblee, of Creskill, N. J. Combined with a door having top and bottom openings are slides for closing and uncovering them, and a mechanism for operating the slides automatically and by hand, so the door can be opened and closed without affecting the covers of the openings, or the openings can be uncovered and closed while the door is shut.

A sheep shears has been patented by Mr. Elijah Kellogg, of Reno, Nev. Combined with a handle having on the forward end of its under side a slotted stud is another handle having a stud at the rear end of its outer side, with a strap secured to both studs, making a pivoted joint with large bearing surfaces capable of supporting the shear blades and preventing them from being separated when doing heavy shearing.

A lime distributer has been patented by Mr. John Hotham, of Hillside, Pa. It has wheels pivoted beneath the discharge openings of the hopper with curved radial flanges and connected by gearing with a rear wheel of the machine, the size of the discharge openings being regulated by sliding plates, the lime in the lower part of the hopper being agitated and made to pass out freely by a shaft with radial pins.

A cracker machine has been patented by Messrs. William H. Bromley and Philip J. Gately, of Brooklyn, N. Y. It has an elastic bed plate resting upon eccentric rollers, so that by turning the latter the bed plate can be readily adjusted according as the desired thickness of the sheet of dough or the wear of the cutters may require, the rollers having worm wheels and a worm to facilitate their operation.

A car starter has been patented by Mr. Theodore F. Bourne, of Bloomfield, N. J. A ratchet wheel is fixed to the car axle, and a lever is pivoted to a swinging support and carrying a pawl adapted to engage the ratchet wheel, a chain or coupling connecting the lever to the draught bar, there being a stop between the lever and the swinging support, the lever operating to help turn the axle on a continued draught strain.

A plaster of Paris splint has been patented by Messrs. John W. Bender and James C. Hinkle, of Shippensburg, Pa. It consists of segmental sections moulded internally to the shape of the limb, and having on their meeting edges interlocking projections and sockets, with coincident strap grooves in their outer sides, the sections to be made in any desired number of pieces, so that one or more may be removed at a time by the surgeon or nurse.

A roving frame has been patented by Messrs. Richard Curtis and William H. Rhodes, of Manchester, Eng. This invention relates to slubbing, intermediate, and roving or jack frames, and is intended to improve the mechanism for imparting a gradully decreasing speed to the bobbins, so they will always draw the slubbing or roving from the front rollers at a uniform speed, notwithstanding the increase of the diameter of the yarn on the bobbins as they become filled.

A horseshoe has been patented by Mr. Lawrence Schwaab, of New York city. This shoe is intended to be fastened to the horse's hoof without nails, and is made in two parts hinged to each other at their forward ends with an inwardly inclined rim on their outer edges, and having a plate formed on one part to overlap the other part; the shoe has a pad with a buckle and strap at its rear end, and projections on its sides to engage with apertures in the sides of the rim of the shoe, to protect the hoof from jar in traveling.

A candy machine and a cake machine are the subjects of two patents insued to Mr. Daniel M. Holmes, of Arlington, N. J. The first machine has a steam heated chamber, which keeps the candy in a melted condition, and from this chamber definite quantities are fed, either upon plates on an intermittently moved endless apron or into pits or moulds formed in starch trays, in an automatic and continuous manner, for the rapid and economical production of formed or moulded candies; the cake machine is of that class in which the dough is fed down from a hopper into a series of cylinders, whence it is forced by reciprocating plungers in small lumps upon pans carried by an endless apron, and the invention covers improvements in the several parts of the machine to increase its efficiency and range of use.

NEW BOOKS AND PUBLICATIONS.

MAGNETO AND DYNAMO ELECTRIC MACHINES. From the German of Glaser de Cew, by F. Krohn, and edited with many additions by Paget Higgs, LL.D., D.Sc. London: Symons and Co., 1884.

This volume is the first of a new Specialists' Series edited by Dr. Paget Higgs and Professor Charles Forbes, and intended to present in popular form the latest information in regard to recent technical subjects. It is the object of the series to provide practical hand-books, both thorough and easily understood, and, though treating of apparatus in the market, entirely devoid of any commercial advocacy. It is admittedly hard to be perfectly impartial, but the high character of the editors will insure a belief in the honesty of their criticism, if not always in its correctness. The present volume treats of a comparatively new subject, where our experience is necessarily limited, and is, therefore, particularly welcome as a conscientious effort to acquaint the public with the principles underlying the construction of electrical machines. The introduction will be found useful to those but little familiar with the theories of induced currents, as well as interesting historically to all readers. The subject has been divided under the head of machines generating alternating or direct currents rather than in strict accordance with the differences between magneto-electric machines and dynamos. The chapter on storage batteries is of special interest just at this time, as the subject is attracting such general attention. In the appendices is given considerable information in regard to the practical construction of dynamos, and a comparison between the principal ones now in use. The series is introduced in this country by Van Nostrand.

CANOE AND CAMP COOKERY. A Practical Cook Book for Canoeists and Outers. By "Seneca." *Forest and Stream* Publishing Company, New York.

At this time of year, such little books as this seem to introduce the urban resident, and worker in store and counting room, at once to the realities of a roving and camping-out life, for it brings one directly to the practical details on which the comfort and solid enjoyment of such summer excursions perhaps most largely depend. The author speaks from experience, and his suggestions as to outfit, choice of *menu* to lay out for different kinds of expeditions, management of the fire, and the best ways of cooking afford sufficient variety to satisfy a taste with a good deal of discrimination, while the directions are so simple that the veriest novice in such matters cannot fail to quickly acquire therefrom the knack of preparing his own food. Take nothing but what is necessary and which can be compactly stowed, is the author's rule, and this little book, which can be easily tucked in a side pocket, might well be counted an essential of a perfect outfit.

Business and Personal.

The charge for Insertion under this head is One Dollar a line for each insertion; about eight words to a line. Advertisements must be received at publication office as early as Thursday morning to appear in next issue.

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Upright Power Hammers. Beaudry & Cunningham, Boston, Mass.

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If an invention has not been patented in the United States for more than one year, it may still be patented in Canada. Cost for Canadian patent, $40. Various other foreign patents may also be obtained. For instructions address Munn & Co., SCIENTIFIC AMERICAN patent agency, 361 Broadway, New York.

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Knots, Ties, and Splices. By J. T. Burgess. A Handbook for Seafarers and all who use Cordage. 12mo., cloth, illustrated. London, 1884. Sent, postage prepaid, on receipt of 75 cts., by Munn & Co., New York.

Send for catalogue of Scientific Books for sale by Munn & Co., 361 Broadway, N. Y. Free on application.

C. B. Rogers & Co., Norwich, Conn., Wood Working Machinery of every kind. See adv., page 62.

If you want Engines, Boilers, or Machinery of any kind, send your address to Henry I. Snell, 135 North Third Street, Philadelphia.

Curtis Pressure Regulator and Steam Trap. See p. 12.

Wood Working Machinery. Full line. Williamsport Machine Co., "Limited," 110 W. 3d St., Williamsport, Pa.

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Barrel, Keg, Hogshead, StaveMach'y. See adv. p. 76.

Mineral Lands Prospected, Artesian Wells Bored, by Pa. Diamond Drill Co. Box 423, Pottsville, Pa. See p. 46.

The "Improved Green Engine," Automatic Cut-off. Providence Steam Engine Co., R. I., *Sole Builders.*

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Notes & Queries

HINTS TO CORRESPONDENTS.

Names and Address must accompany all letters, or no attention will be paid thereto. This is for our information, and not for publication.

References to former articles or answers should give date of paper and page or number of question.

Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all, either by letter or in this department, each must take his turn.

Special Information requests on matters of personal rather than general interest, and requests for **Prompt Answers by Letter,** should be accompanied with remittance of $1 to $5, according to the subject, as we cannot be expected to perform such service without remuneration.

Scientific American Supplements referred to may be had at the office. Price 10 cents each.

Minerals sent for examination should be distinctly marked or labeled.

(1) P. & M. ask if running an electric motor on a watch maker's bench would tend to magnetize watch balances, or would it be safe to operate an induction coil for the purpose of giving shocks where the above work is going on? A. Either the mo[redacted] battery, so as to tell or know at any time how much is on hand? A. By means of the voltmeter or ammeter placed in a shunt of the main circuit.

(3) H. W.—Ordinary machinery steel is generally used for telephone magnets; they are hardened at the ends only, usually by heating to a red heat and plunging into cold water. Cast steel is no better than machinery steel, but if used its temper should be drawn to a dark straw color.

(4) P. W. B.—The north-seeking pole of a magnet is attracted by the earth's north pole, and the south seeking pole is repelled by the earth's north pole, but the "why" has never been ascertained.

(5) O. Z. writes: How is paraffine dissolved quickly? I receive tools and toys from the old country (Germany) covered with a coat of paraffine, to prevent rust I suppose. It makes them sticky to the feeling, and I want to remove the paraffine before selling the articles. A. Naphtha or gasoline dissolves paraffine; a little on a small rag, and rub the articles.

(6) W. F. L.—Fishes balance themselves in water by the muscular contraction of the air bladder. By death the muscles relax and the air bladder expands, raising the fish to the surface. The center of gravity being in the air bladder, which is located in the abdomen, brings the belly up when the fish floats.—In regard to electroplating, see SCIENTIFIC AMERICAN SUPPLEMENT, No. 310, and Wahl's Galvanoplastic Manipulations, $7.50, Watt's Electro Metallurgy, $1.00, which may be had through this office.—We charge for an analysis of minerals only, not for an opinion of what they are.

(7) J. L. M.—We know of no special rules or formulas for the relation of coil to size of wire in spiral springs. Their use, strength, elasticity, and amount of extension required are the special considerations in their proportions. Could not give you the recoiling force of a spiral spring. The only way is to make a trial.

(8) J. S. M. asks: 1. What are the conditions on which so many patents are issued on telephone transmitters, wherein the variation of the resistance of carbon by pressure is the principal feature? In other words, why are patents issued to Draughbaugh and others for carbon transmitters when Edison is the first inventor and patentee? A. If you will examine the patent, critically, you will find tnat they are not issued for the same thing, although they may contain some of the same elements. They are generally for different combinations of the elements required to produce a telephone. 2. What are the conditions on which patents on magnetic telephone receivers are issued to other parties since the invention of Graham Bell? A. The same may be said with regard to telephone receivers. 3. Is there any practical form of telephone relay in use giving good results? A. We believe not. 4. Is there any practical form of loud-speaking magnetic telephone that can be heard through a large hall by an entire audience? A. No. 5. Would the invention of an efficient magnetic separator capable of separating 15 or 20 tons of magnetic sand per day be of any great value to the industries? A. Separators of this class are in use; any improvement will have some value. 6. Is magnetic sand used in any part of the country in the manufacture of iron and steel on a large scale? A. We believe it is used to some extent.

(9) S. B. G. writes: It is said that the magnetic needle stands at right angles to a current of electricity which encircles the earth eastward and westward. If it is so, please explain what causes the variation of the magnetic needle, or rather the variation of the magnetic current. A. We do not know that the explanation of the action of a magnetic needle is correct. We believe an explanation of the variation of the earth's magnetism is yet wanting. We regret that we are unable to supply it.

(10) H. I., Jr., asks for a mineral or substance that, when placed between a horseshoe magnet and a piece of iron, the former will not affect or draw the latter toward it. A. No substance having the properties you require has yet been discovered.

(11) E. J. R. asks how many 2 gallon cells of Bunsen battery, converted into the bichromate of potash battery described in SCIENTIFIC AMERICAN SUPPLEMENT, No. 485, would be required to run one 6 candle incandescent lamp of 10·8 volts and 1·43 amperes. Also what carbon surface, and how deep, should the zincs be immersed? A. You would require 11 to 12 cells. Better use your cells as Bunsen bichromate batteries. They will be more constant than the plunging battery. If you desire to use them as plunging batteries, you may use in each cell 1 zinc plate and two carbon plates, each 4x6 inches. Place a carbon plate on each side of the zinc plate and about ¼ inch distant. You will be obliged to plunge the elements more and more as the solution grows weaker.

(12) F. A. writes: I wish to construct a dynamo, twice as large as shown in SUPPLEMENT, No. 160. 1. Shall I use the same number of wire? A. Use the same number for the armature and No. 12 for the field magnet. 2. Aow much wire shall I use for the electric magnet, and for the armature? A. It would be more or less a matter of experiment; better put on about six layers on the magnet, and bring ends out so that you could connect the different coils up in series or in parallel circuit. 3. How many candle power will it give (arc lamp), how much power required to run it? A. The amount of light produced by such a machine depends entirely upon the manner in which it is constructed. It will probably require at least ½ horse power to drive it.

(13) J. B. W. asks: 1. How many cells of Fuller batteries will it require to light an incandescent lamp of 5 candle power? A. It depends upon the resistance of the lamp. Probably from 10 to 20. 2. What effect do large wires have for a core in an induction coil over small wires? I have made an induction coil after your SUPPLEMENT, and have heard some electricians argue for large wire in core and some in favor of small wires in core. Please state the advantages. Mine is for a shocking machine. A. The smaller wires are preferable, because they are more readily magnetized and demagnetized. 3. What advantage is there in having a large core over a small one? Mine is ½ inch in diameter, and some say if I had it 1 inch it would be stronger. A. By using a large core you would be able to get a larger and stronger magnetic field. 4. Would it not be better to use No. 10 cotton covered wire for primary and No. 18 silk covered for secondary for an induction coil for a shocking machine, for street use? A. Better use No. 16 for your primary and No. 34 or 36 for your secondary.

(14) F. W. W. writes: 1. I have a hunting jacket made of common ducking. Can you tell me what preparation I can put over it to make it waterproof, and not make it stiff and uncomfortable? A. For waterproofing your duck coat, dip it in a solution containing 20 per cent of soap, and afterward into a solution containing 20 per cent of sulphate of copper. Then wash and dry. Another: 1 pound alum, 1 pound sugar of lead; pulverize both finely, and thoroughly mix dry and pour on 2 quarts boiling water. Let it stand 6 hours, when it will be ready. Sponge the coat until it is saturated, then iron dry. 2. If the muzzle of a shot gun is worn a little bell-mouthed, will it have a tendency to make the gun scatter? A. Yes. 3. When brass shells for shot gun expand, through continuous use, how can they be contracted to gauge again? A. Only by using a compressing die, which a machinist should be able to make.

(15) P. P. B.—Balloons, unless of very large size, should be made of the lightest material. Balloons of small sizes would be of little or no service with hot air if made of cotton cloth or ducking. See SCIENTIFIC AMERICAN SUPPLEMENT, No. 127, 312, and 413 on the construction of balloons. A returning bullet increases its velocity from the turning point until it strikes the earth.

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August 4, 1885,

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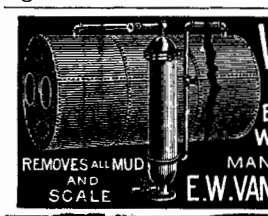

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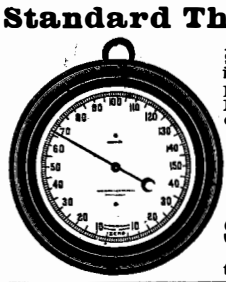

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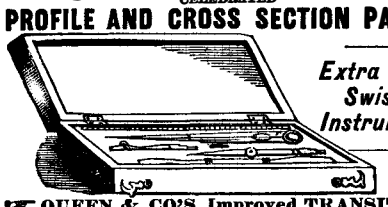

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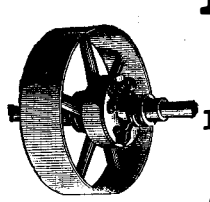

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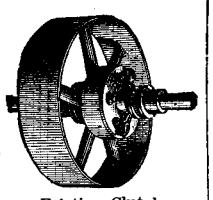

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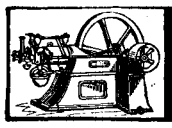

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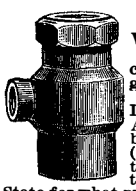

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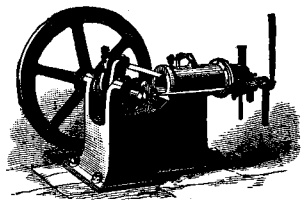

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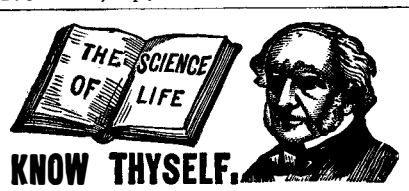

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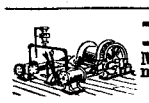

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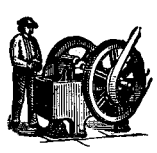

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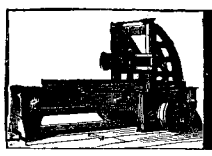

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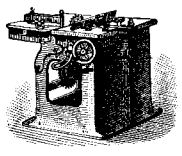

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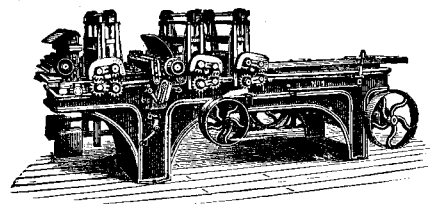

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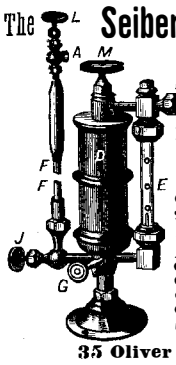

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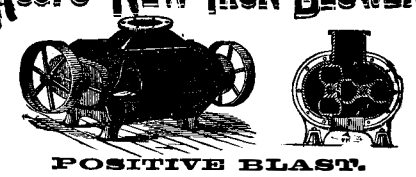

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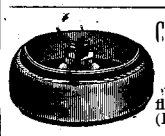

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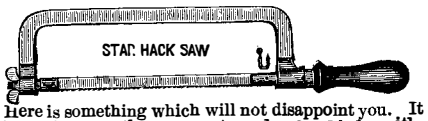

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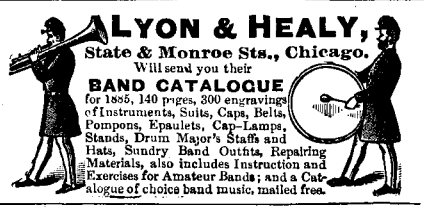

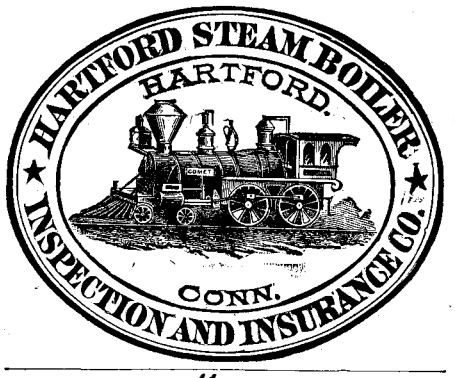

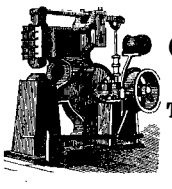

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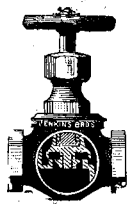

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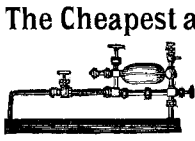

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